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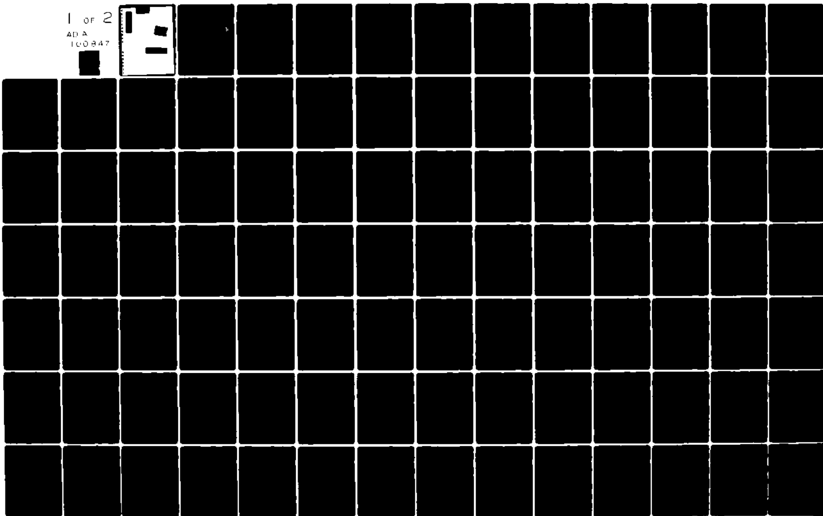

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AIRMICS LARE/CADSAT ANALYSIS

Final Report

by

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~~and~~

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PREFACE

This study presents the results of our application of Logicon's Automated Requirements Engineering (LARE/CADSAT) to two existing U.S. Army Computer System Command (USACSC) Detailed Functional System Requirements Documents (DFSR). The effort was performed by Logicon under Contract DAHC26-80-C-0021.

Logicon wishes to acknowledge the support of Major John S. Davis and Mr. John Mitchell of Army Institute for Research Management Information and Computer Science (AIRMICS).

The authors wish to recognize Ms. Karen Favreau for her outstanding technical support on this project. We also thank Mr. Jeffrey Miller for his contributions, Ms. Deborah Queen for overseeing the final product, Ms. Eileen Fitzgibbon for her graphics and Ms. Jill Andersen for her tireless word processing support.

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1. INTRODUCTION

1.1 Goals and Objectives

This study was conducted to determine the applicability of Logicon's Automated Requirements Engineering (LARE) methodology in the Army logistics support environment. Logicon developed LARE to provide a means to define, effectively analyze, and maintain system requirements. LARE includes a coherent set of procedures which allows analysts to define/analyze requirements using computerized tools. The Computer Aided Design and Specification Analysis Tool (CADSAT) was used on this project. CADSAT was designed to aid structured documentation and analysis of large processing systems. This project used the Air Force's standard CADSAT with the CADSAT extensions developed by Logicon.

The study focused on:

- illustrating the methodology
- defining LARE procedures
- identifying enhancements to LARE

Normally LARE/CADSAT is used to produce or validate specifications for a system and its components. Study objectives did not however dwell on reproducing a set of documents. Replication of system documentation would have prevented the effective evaluation and illustration of LARE technology.

Discussion of the technical feasibility of building the system was also excluded from the study. No functional or analytical simulations were performed to assess performance requirements with respect to timing and accuracy constraints. While these subjects are crucial to system design, they are outside the scope of this effort.

1.2 Background

Development of major systems is an increasingly complex problem. This problem manifests itself in varying degrees of successful system implementations but has its roots in differing perspectives. Users, analysts, developers, and managers concentrate on that portion of a system for which they are directly responsible -- a potentially expensive situation. Effective system implementation demands that someone comprehend the total system under development to allow effective management of its progress.

No completely automated way, at this time, can ensure the absolute success of a target system. This study addresses one approach to reducing the difficulties inherent in defining complex systems. LARE centralizes information storage in a set of databases. Using LARE to model existing specifications or develop an initial concept for an operational system will significantly improve the quality of the system and its documentation, thus easing the implementation, testing and operations/maintenance phases of the project.

LARE developed on these precepts:

- valid requirements definition is critical to successful system implementation,

- computerized information storage should be used to maintain all basic data about a system,

- selected retrieval of stored information in formats suitable to users and developers is essential, and

- traceability between levels of system documentation is mandatory.

Defining a valid set of requirements before development work starts minimizes system costs. It is generally recognized that one reason for the high cost of systems development is the delay in detecting errors, inconsistencies and omissions in the requirements/specifications.

LARE prevents some problems and detects others early. LARE language constructs force analysts to be precise. The output reports make errors, omissions and inconsistencies highly visible.

Storing the requirements and specifications in centralized databases facilitates:

- selective retrieval

- up-to-date documentation

- life-cycle maintenance

- standardization of terminology

- incremental information updates

Selective retrieval of centrally-stored information allows individuals on a project to get information pertinent to their jobs. Managers, analysts and programmers require different types of information to do their respective jobs.

Requirements tracing is the process of ensuring that all general requirements in a high-level specification have detailed counterparts in lower-level specification(s).

Every requirement must be traceable through all levels of system documentation to ensure that the system fully meets the user needs -- and that every stated need has been addressed in the allocated requirements and design.

In the last few years, both government and industry have begun to recognize the necessity of doing thorough requirement analyses. Managers responsible for the development of information systems find themselves plagued by poor quality documentation, unstructured requirements and specifications, and the inability to verify the consistency and completeness of system requirements and specifications.

These problems begin in the initial stages of system development and their impact increases in terms of time and cost over the system's life cycle. For example, inconsistent, incomplete requirements foster inconsistent, incomplete specifications, which translate into design errors. These flawed designs are turned over to developers who find them difficult and in some cases impossible to implement.

In 1971, the Problem Statement Language/Problem Statement Analyzer (PSL/PSA) was developed at the University of Michigan (Teichroew, Hershey and Sayani). PSL/PSA is a language for describing system requirements and design. The Air Force acquired a slightly modified version called the User Requirements Language/User Requirements Analyzer (URL/URA). URL/URA is also referred to as the Computer Aided Requirements Analyzer (CARA) and the Computer-Aided Design and Specification Analysis Tool (CADSAT).

All variations of the tool have three main parts and a common problem. The first part is a language to express system requirements. The second is a database system to store the requirements. The third is outputs/reports to depict the requirements. All tool variants lack a documented methodology for application.

Logicon's enhanced CADSAT is the result of an evaluation which found URL/URA lacking in the following areas:

- visibility into the database(s)
- traceability between databases
- documentation acceptable by Military Standards

CADSAT therefore differs from PSL/PSA in its output capabilities (Figure 1-1). CADSAT provides a systematic approach for building information systems, but it soon became apparent that an approach to effectively using it was essential. Logicon's Automated Requirements Engineering (LARE) methodology was developed by applying CADSAT over a period of five years (Applications include programs done for the Air

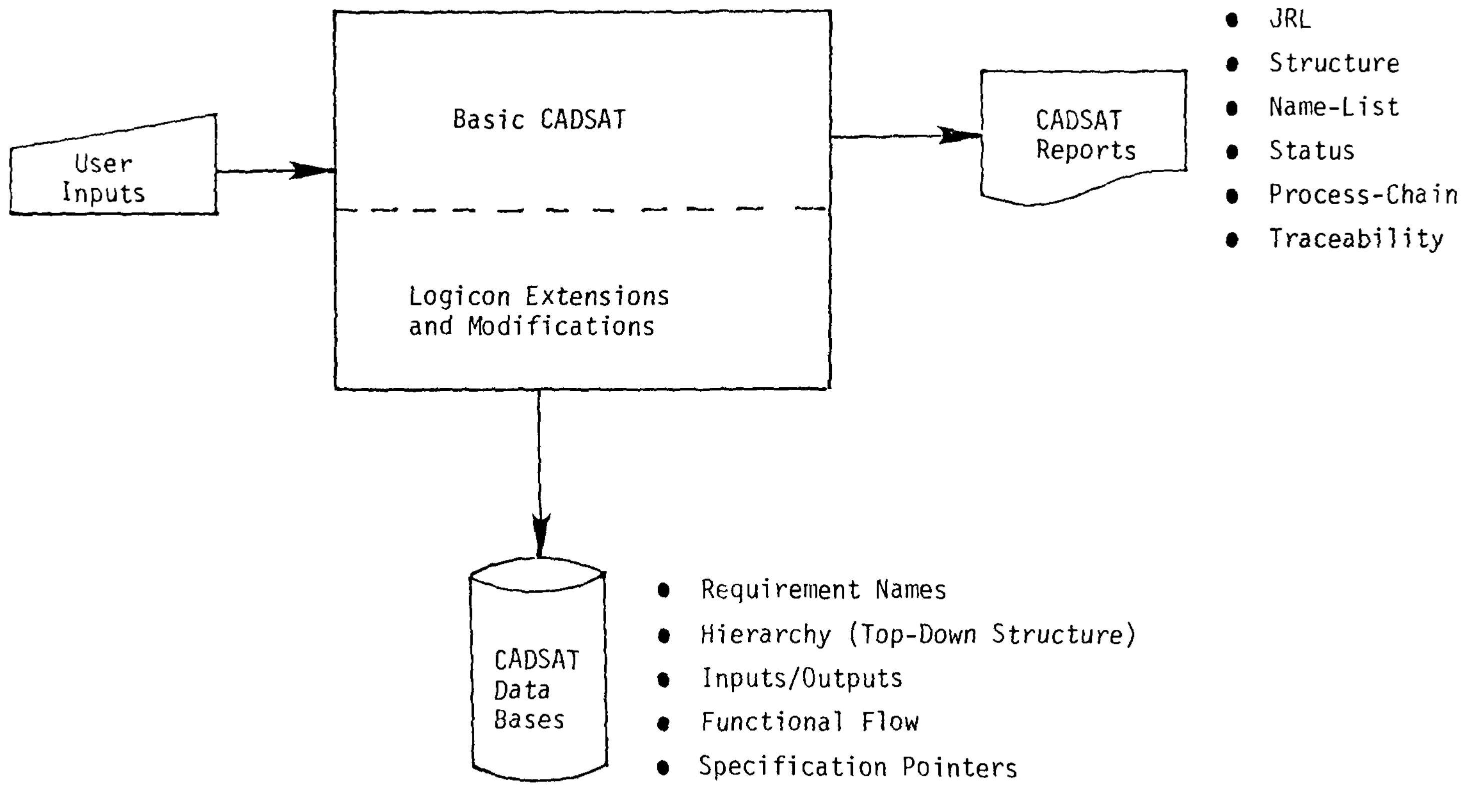

Figure 1-1 Functional Overview of CADSAT

Force, Army, Navy and other defense/Government agencies). Hereafter, the term LARE will refer to both the tool and the methodology used to apply it.

1.3 Summary of Conclusions and Recommendations

Under analysis were the Standard Army Maintenance System (SAMS) - Retail Level, Maintenance Operations Management (SAMS-1/MOM) and the Maintenance Program Operations Management (SAMS-2/MPOM) specifications, hereafter known as the MOM and the MPOM respectively. The MOM contains approximately 2,100 pages. About 85 pages of narrative discuss system functions and constraints. Design discussions and solutions also appear in the narrative. The balance of the MOM is contained in nine annexes which consist of input/output descriptions, flowcharts, decision tables, file descriptions, information elements, external interfaces, telecommunication requirements, and a glossary of terms. MPOM uses the same format and information breakdown, but is considerably smaller.

The study demonstrated that LARE could effectively describe both specifications. Details necessary to describe both systems were translatable into LARE and representable by LARE outputs. As analysts found information they could not justify or information felt to be inconsistent or incomplete, Discrepancy Reports were written. Table 3-2 and 3-3 in the Results Section summarize the types of discrepancies noted and the number of discrepancies formally written up.

Briefly, Logicon recommends the following:

1) Simplify LARE's man/machine interface by incorporating user prompts.
2) Improve LARE's ability to record and depict conditional control flow.
3) Augment LARE's ability to record and depict test requirements.
4) Enhance LARE's database management system.
5) Apply the enhanced LARE to the specification of an Army system from initial requirements definition through implementation.

2. TECHNICAL APPROACH

2.1 Introduction

This section describes the technical approach used in applying LARE to the example Army Detailed Functional System Requirements (DFSR).

Figure 2-1 shows the basic steps of the technical approach. Each of the steps is described within this section. In addition to describing the procedure, the discussion includes the rationale underlying decisions.

The emphasis of this application has been to demonstrate the applicability of LARE to the Army DFSRs, illustrate LARE'S strengths and weaknesses, and document the experience gained during the study.

2.2 Development of Requirements Engineering Plan

At the beginning of each project an individualized set of appropriate conventions are developed. This enables analysts working on the project to move uniformly toward a common goal. LARE provides a generalized methodology applicable to most system development cycles. Each project requires some tailoring of LARE. Details of the Requirements Engineering Plan developed for this effort appear in Appendix A.

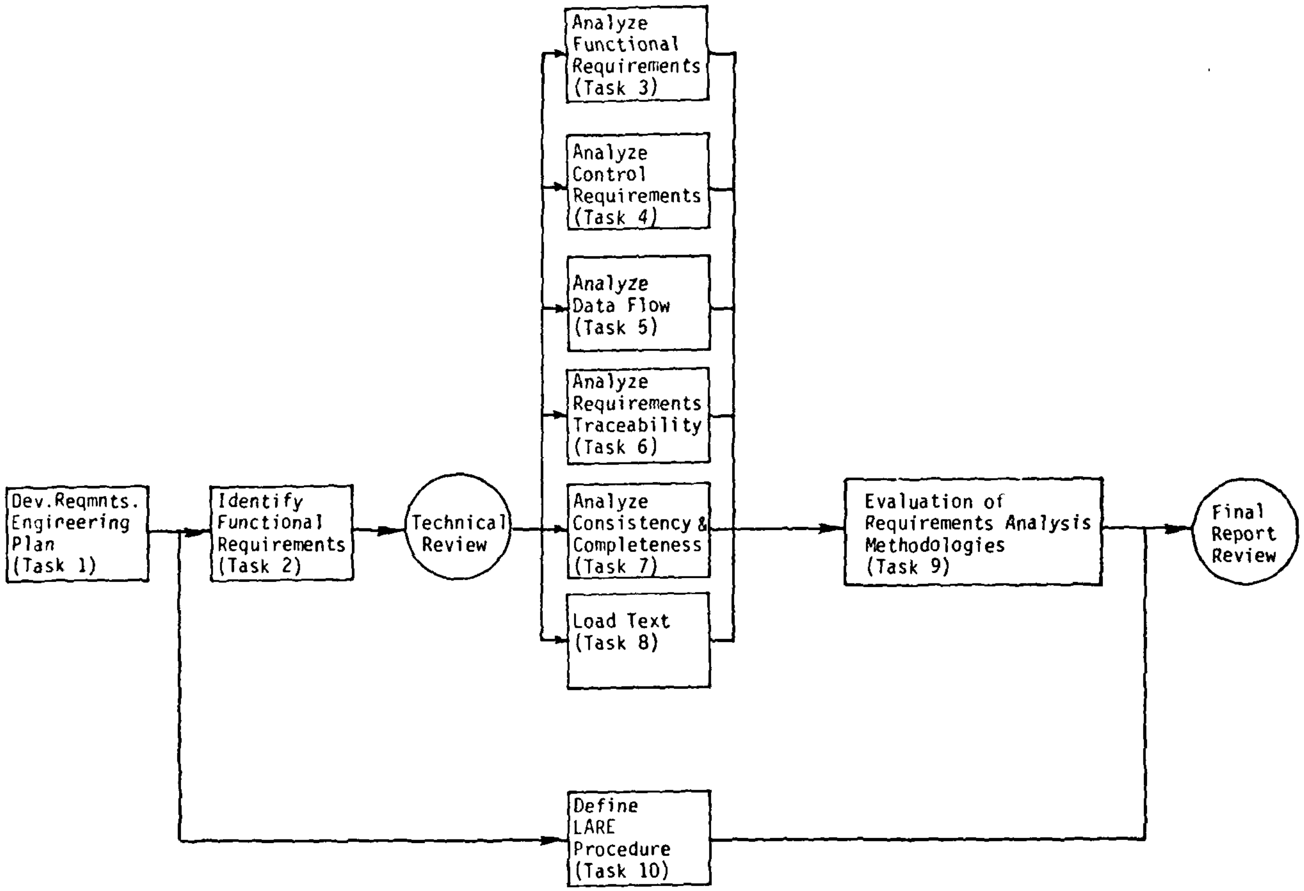

Figure 2-1. Task Overview for AIRMICS Study

The first step of the project was familiarization with the MOM and MPOM specifications. Analysis was isolated from the developmental effort responsible for the specifications. They were therefore represented based on several assumptions:

- Both systems consist of functional requirements
- These functions are connected or interrelated in various ways
- The main purpose of both systems is to process data
- Properties and values impact design

After reading the MOM and MPOM documents, we split tasks into major areas of concentration.

- Develop evaluation criteria. Evaluation criteria were set up to gauge LARE's ability to support requirements engineering (See Table 2-1). The criteria consider only the analysis of existing specifications.
- Refine standard Requirements Engineering Plan. The Requirements Engineering Plan given to analysts in the early stages of this application is included in Annex A. Specifics of the plan pertinent to this project include: generate a synonym algorithm, identify reports to be produced, and select CADSAT language to represent information in the specifications.
- Define and depict functional requirements. Sections 2.4 through 2.9 detail our approach to requirements definition.

- Evaluate alternative technologies. Section 2.10 and 3.10 discuss our brief evaluation of alternative requirements engineering aids.

2.3 Identification of Functional Requirements

Each specification was reviewed and the task of identifying functional requirements started. At this stage, analysts searched the documents paragraph by paragraph extracting and naming what they determined to be functional requirements of the system.

Conventions used for identifying and naming requirements are detailed in the Engineering Plan found in Appendix A, Section A.4.

2.4 Analysis of Functional Requirements

Once the functional requirements of the system had been identified, a high-level requirements hierarchy was built. The first hierarchy emphasized the input, internal, and output processing of the system. This approach was used since the target system is a Management Information System. The three categories, though strongly emphasized did not allow us to adequately decompose the system requirements. Because of this, a second hierarchy was built. The modified structure emphasized the type of data being processed (e.g., process-work-orders, process-task-performance-data, maint-parts-inventory). The input/output processing for each of these areas is represented at a lower level of the system hierarchy.

After finalizing the high-level hierarchy, the detailed functions to be performed were selected and incorporated into the process structure.

2.5 Analysis of Control Requirements

Data and system control flow are closely related. LARE defines control flow as the order in which system functions are sequenced. Data derived by functions early in a sequence often impact the next sequence of events. Data flow (i.e., the flow of information into, through and out of the system) may be interrupted by system functions temporarily suspended and awaiting the proper control sequence. Data inputs often cause spontaneous execution of specific processing.

Primary objectives of control flow analysis are to identify:

- timing relations among target system functions
- functions omitted by previous steps in the order
- missed requirements of a target system

Due to the complementary nature of LARE, control flow analysis may be performed in two ways. The first defines a sequence which initializes processing at the point in the processing when it crosses system boundaries. Possible subsequent sequences of steps or processes are recorded, analyzed and inserted in the database. The resultant chain shows all possible processes that may be performed, including

parallel or mutually exclusive ones. Mutually exclusive processes imply a decision made during performance. A second method of analysis starts at the output and traces back through the internal sequence which caused this end result. This process, like the first, yields parallel and mutually exclusive threads of process control. Identifying and following these threads through the system frequently reveals functions which were omitted or input requirements that had been overlooked.

2.6 Analysis of Data Requirements

The primary objectives of Data Analysis are:

- identify information crossing the external system boundaries
- determine the information deciding control flows
- determine the outputs requiring inputs

At the requirements definition stage of system development, the "real" data requirements are data crossing external system boundaries. These data items must be defined precisely and carefully controlled since they always impact the ability of the target system to interface with other systems.

Identification of information required to determine which internal functions the system will perform is closely tied to the control flow analysis. If this information is not provided in the system, it will not operate.

The third part of data requirements analysis determines the inputs necessary to produce required outputs. All too often, system data requirements are unclear or input/output data are identified as "nice to record" or "nice to know". As a result, requirements definition is vague. This vagueness impedes the development of an operational system. Required outputs should first be justified in terms of their utility to the user or other external system. An output should be specified in terms of frequency and accuracy constraints. Once an output is deemed required, an analysis must be performed to identify information elements necessary to produce the output. The algorithm used to transform inputs to output must also be determined. The final inputs identified must be shown to be available.

2.7 Analysis of Requirements Traceability

Requirements traceability is defined as the process of ensuring that upper-level requirements are allocated in the lower levels of documentation.

It was originally thought that a traceability analysis could be performed between the MPOM and MOM specifications. Closer examination of these specifications showed that they were distinct systems to support different Army Management levels, not different levels of specification of the same system. Although this analysis could not

be performed on the specifications used in this study, a discussion of the methodology is included in this report.

A typical analysis would trace through the following levels of documentation:

- GFSR to DFSR
- DFSR to actual system test requirements
- DFSR to the system design implemented to meet the requirements.

2.8 Analysis of Requirements Consistency and Completeness

The consistency and completeness of requirements has been mentioned throughout the above discussion. No analytical technique exists to assure the completeness of a set of requirements. The LARE approach cuts through the target system requirements from multiple perspectives and provides the analyst with a relatively small number of items to review. The analyst then assesses completeness.

The first type of completeness analysis is hierarchical analysis. If a system has 2,000 requirements defined, it is difficult to determine whether the requirements are complete or whether there should be 2,001 requirements. With hierarchical analysis, each requirement is decomposed into four to seven components. At each step of the decomposition

the question is asked: Does the sum of the sub-requirements completely describe the requirement at the next level up? If the answer is yes, the decomposition of that requirement stops; if no, the missing requirements are identified. This process continues until the analyst feels that the requirement has been accurately broken down. This approach looks superficially similar to that used in generating most requirements documents. Specification formats usually call for a hierarchical paragraph numbering scheme. The primary difference is that LARE requires the strict logical relationship of parts between each paragraph and its subparagraphs.

Next, data must be analyzed for consistency. At the requirements stage, the basic objective is to identify the type of data needed and derived by each process. This identification procedure helps to ensure that data is derived prior to being required. It also helps flag data derived by multiple functions. This data should not be described in detail at the requirements definition stage. Defining the detailed layout of internal data is a problem for system design and not for requirements specification.

Consistency analysis is predominately a problem of sorting through multiple statements of individual functional requirements. Consistency of requirements does not manifest itself until all statements are pulled together. LARE aids the analyst in assembling the information and storing it logically. Inconsistencies are not limited to functional requirements. They can appear in constraints (e.g., performance requirements), information content, control flow, data units (e.g., time to repair equipment in hours vs. days of a person's time).

2.9 Loading of requirements text

System specifications are frequently viewed as a necessary evil which must be generated at the beginning of system development only to be forgotten once system construction begins. This should not be the case. Up-to-date system specifications, are relevant throughout the system life cycle. Requirements generally undergo changes during system development. To minimize system life cycle costs, analyze the impact of requirements before developing system updates. Otherwise, implementing new system capabilities or changes will cause other system errors or problems.

LARE greatly enhances the ability to maintain up-to-date system specifications. The effort required to print change pages or entire specifications ready for publication is greatly reduced. In addition, LARE provides a single integrated database representation of the specification. This minimizes divergence of functional and data structures from the requirements specification text representation - likely occurrence if text is maintained manually or in a separate word processor.

2.10 Evaluation of Several Existing Requirements Analysis Methodologies

A cursory review was made of two additional computer-aided requirements analysis tools and methodologies. Input/Output Requirements Language (IORL), and Software Requirements Engineering Methodology (SREM) were chosen because both are being used by the Army and are the focus of independent technological demonstrations similar to this study. A comparative evaluation was made of these technologies and LARE.

Logicon developed LARE and greatly enhanced the computerized tool (CADSAT) used by the methodology. However, Logicon is committed to the evolution of computer-aided requirements analysis and specification generation independently of the specific tools used. The objective of the evaluation was to identify the strengths and weaknesses in capabilities of tools to represent system documentation. The evaluation Criteria are shown in Table 2-1.

Table 2-1. Evaluation Criteria

Ease of:
- database modification
- report generation
- report readability

Ability to:
- record/depict functional requirements
- record/depict constraint requirements
- record/depict control flow
- record/depict data flow
- record/depict functional hierarchies
- record/depict data hierarchies
- record/depict interfaces
- record/depict external documents
- record/depict test requirements
- record/depict project status

Ability to:
- aid in detection of incomplete data
- aid in detection of inconsistent data
- aid impact analysis

Ability to:
- generate system specifications
- generate test specifications
- generate design documentation

Ability to:
- simulate (general)
- trace requirements
- trace between levels of documentation
- provide diagnostics
- provide well defined methodology

3. RESULTS

3.1 Introduction

The results section presents the findings in the same order as the technical steps described in the previous section. Tables and report illustrations are included in this section. Longer example reports have been included in Appendix D. Reports produced by LARE, except the specification report, are analytical aids. These reports constitute a snapshot of the database.

3.2 Requirements Engineering Plan

The Requirements Engineering Plan (see Appendix A) developed for this project includes all the basic elements used by project personnel. It is however, simpler than one for a project which uses LARE as the primary tool to develop a complete system specification. A project using more people over a longer interval would include extensive discussion on requirements traceability, use more LARE reports, and discuss the tracking of requirements changes/discrepancies at length.

One key element of the plan is the identification of system boundaries. The project was provided the MOM and the MPOM specifications. These specifications detail a set of requirements for two systems, or possibly two subsystems, of a much larger system, the complete SAMS (wholesale, retail and all levels of user/management). Each of the

specifications refer to data processing functions (both manual and computerized), maintenance inspections, actual maintenance/repair, and maintenance planning.

It was decided to treat the MOM and MPOM as separate systems for analysis. Thus, communication between these two systems becomes external. Furthermore, the system boundary was defined to include only manual and automatic data processing functions.

Manual data processing functions were included, although they were not as well defined as the automatic functions, because the line of demarcation between manual and automatic processing functions might change in the future. Also, including manual functions enables clearer documentation of the requirements,

Discussions of maintenance, inspection, or maintenance system planning are considered descriptive (in terms of our definition of system boundaries) and are not addressed as functional requirements. This is not to imply that this material should be removed from the document; it frequently helps the reader understand the actual functional requirements. Another implication of our system boundary definition -- personnel operating the eventual system may be part of the system or an external interface. Operators become part of the system whenever they perform manual data processing functions, e.g., developing a list of non-operational equipment by going through a file containing equipment status for each item. Physically locating each piece of equipment and inspecting it to determine operational readiness is not a data processing function. The operator performing this task is not directly related to the system as defined. Entering the results of an inspection into a box on an inspection sheet, onto a form for keypunching, or directly keying the results into a computer terminal, all constitute the

"input" of data into the "system" from an external "interface". In this case, the operator is the external "interface".

3.3 Functional Requirements Identification

Functional requirements for both systems were broken down into discrete requirements. As with all specifications for which LARE has been applied, the requirements were found to be scattered throughout the documentation. Most requirements were identified from the text portion of the specifications. Analysis of appendices primarily identifies data inputs/outputs, i.e., data from or to external sources or external users.

In addition to functional requirements, other requirements were identified which do not "do" something but say something about how or when things are done. These requirements are called constraints, and were defined mainly in the MPOM database.

After identifying a functional requirement a descriptive LARE name was assigned, a synonym was defined, and a paragraph reference linked to the analyst assigned name. Figure 3-1 is an example of how functional requirements are extracted from paragraphs in the MOM specification and translated into LARE terminology. The figure also shows how the same function is repeated in several paragraphs. Figure 3-2 was generated by prompting the database for all names associated with paragraphs m-4.10.g, m-4.10.q, and m-4.10.x.5 (MOM). One of LARE's greatest assets is that it stores information once but allows that information to be accessed in numerous ways.

```
CADSAT Version  3.2R2                                    APR 28, 1981  09:17:24      page    1
                              LOGICON LEXINGTON VAX SYSTEM

                                   process structure

 parameters for: str

   process indent=3 noindex

count level name                                  reference

   1  4 enter-standard-wo-data
   2      5 assign-equip-recall-reqmnt-won         m-4.14.b
   3      5 assign-intra-shop-wo-numbers           m-4.10.x.2
   4      5 ent-assigned-work-order-number         m-4.15.b
                                                   m-4.17.a
   5      5 enter-work-order-task-data             m-4.10.g
                                                   m-4.10.x.5
                                                   m-4.10.q
   6      5 enter-wo-evacuation-data               m-4.10.r
   7      5 process-maintenance-request            m-4.14.e
   8      5 register-intra-shop-work-order         m-4.10.x.2
   9      5 enter-work-order-parts-data            m-4.12.d
  10         6 enter-wo-supplmntal-parts-data         m-4.12.h
                                                      m-4.12.k
  11         6 enter-wo-parts-reassignments           m-4.10.ss
  12            7 re-assign-wo-parts                     m-5.8.o
  13         6 xm-co-dectbl-input-datacheck
  14         6 xm-cs-dectbl-input-datacheck
  15         6 process-edit-subprocess                m-h-table-no231
  16      5 enter-registration-wo-data             m-5.4.a
  17         6 xm-a-dectbl-input-datacheck
  18         6 xm-b-dectbl-input-datacheck
  19         6 process-wo-registration-data
  20      5 enter-wo-requirements-data             m-5.8.b
                                                   m-5.10.b
  21         6 process-wo-requirements-tasks          m-h-table-no201


level count   level count   level count   level count   level count
  1     0       2     0       3     0       4     1       5    10
  6     9       7     1
```

INTERFACE OR PROCESSOR

4-10g. The $\boxed{\text{Shop Office Clerk}}$ keys for entering Task and MHR data entry (Document Identifier Code XMC(T)). When prompted by the processor, the data for the Task Requirements (I2 Ø3 KZ) are entered. Preparations are then made to enter the WO status into the WORF.

4-10X(5). The Shop Office Clerk keys for entry of task and man-hour data (Document Identifier Code XMC(T) (I2 Ø3 KZ)) (ref para 4-10g).

4-10q. The Shop Office Clerk keys for Task Completion Data entry (Document Identifier Code XMD(T)). (If man-hour accounting is in effect, a Document Identifier Code XMD(L) will be used.) When prompted by the processor, the Task Completion Data (I2 Ø4 KZ) are entered.

Figure 3-1. Example of MOM Text Translated into LARE

```
CADSAT Version  3.2R2                                          APR 28, 1981  10:10:13      page    1
                                   LOGICON LEXINGTON VAX SYSTEM
                                   formatted problem statement

parameters for: tps

   file noindex print empty nopunch smarg=5 nmarg=20 amarg=10 bmarg=25 rnmarg=70 cmarg=1 hmarg=40
   nodesignate one-per-line define comment nonew-page nonew-line noall-statements
   complementary-statements line-numbers printeof

define                                        m-4.10.g
     as a source;
    applies to:    enter-work-order-task-data,
                   enter-work-order-time-expended,
                   enter-wo-completion-data;

define                                        m-4.10.g
     as a source;
    applies to:    documentation-identifier-code,
                   manhour-accounting-reqmnt-opt,
                   enter-wo-completion-data,
                   enter-work-order-task-data,
                   enter-work-order-time-expanded;

define                                        m-4.10.x.5
     as a source;
    applies to:    enter-work-order-task-data,
                   enter-work-order-time-expended;

eof eof eof eof eof
```

Figure 3-2. Example of Specific Data Retrieval

3.4 Functional Requirements Analysis

The primary objective of the functional requirements analysis is to take the discrete functions identified in the previous step and tie them into a consistent, understandable functional hierarchy. The hierarchical structures of both systems were made as similiar as possible. These structures include much of the organization already contained in the specifications.

Functional requirements from the MOM were loaded into a LARE computerized database first. Management information systems, including maintenance information systems, are frequently organized around the concept of input, processing, and output. The initial high level MOM hierarchy is shown in Figure 3-3. This structure does not lend itself to an easy representation of the lower functional structure. One difficulty is that minimal internal processing is required. For the most part, data comes into the system, is stored, and is reprinted in various formats.

A second hierarchy, developed for the MOM specification, was organized closely to the original specification (see Figure 3-4 for the top-level hierarchy). In this structure the input, process, output sequence repeats within each major area. This structure handles the lower level functions more easily than the original. The structure requires continued analysis in order to meet the objective in the engineering plan: each functional requirement to be decomposed should yield 4 to 7 subfunctions.

Once the MOM high level hierarchy had been built, the MPOM functional requirements were organized into a structure which retained as much

```
CADSAT Version  3.2R2                                        APR 26, 1981  14:29:22      page     1
                              LOGICON LEXINGTON VAX SYSTEM

                                    process structure

   parameters for: str

      process indent=1 noindex

  count level name

      1   1 sams-retail-mom-system
      2     2 input-processing
      3       3 annotate-work-order
      4       3 annotate-repair-parts-form
      5       3 annotate-shop-supply-list
      6       3 annotate-proper-forms
      7       3 inspection-wo-status-change
      8       3 enter-hslf-change-data
      9       3 enter-class-inspectn-form-data
     10       3 enter-equipment-usage-data
     11       3 record-received-parts
     12       3 enter-maintenance-request
     13       3 enter-shop-supply-data
     14       3 determine-required-calibration
     15       3 detrmne-required-maint-service
     16       3 enter-work-order-data
     17     2 internal-data-processing
     18       3 request-wo-registration-data
     19       3 record-parts-status-on-rpf
     20       3 transfer-data-to-rpf
     21       3 data-retrieval
     22       3 work-order-update
     23       3 transfer-wo-data-computr-media
     24       3 work-order-closeout
     25       3 sort-repair-parts-forms-ind
     26       3 post-cancel-reconcil-resp-meda
     27       3 float-processing
     28       3 process-lookup-table-data
     29       3 parts-tracking-handling
     30     2 output-processing
     31       3 send-wo-with-equipment
     32       3 distribute-tpf-data
     33       3 enter-personnel-data-changes
     34       3 report-generation
     35       3 generate-rpor-transfer-file
     36       3 transmit-dist-work-ords-data
     37       3 output-magnetic-transfer-media


  level count   level count   level count   level count   level count
      1     1       2     3       3    33
```

Figure 3-3. Initial High-Level MOM Hierarchy

```
CADSAT Version  3.2R2                              APR 27, 1981  11:33:12     page    1
                          LOGICON LEXINGTON VAX SYSTEM
                                process structure

parameters for: str

  process indent=3 noindex

count level name

  1   1 sams-retail-mom-system
  2      2 produce-support-plan
  3         3 maint-support-plan
  4      2 process-work-orders
  5         3 enter-initial-wo-data
  6         3 reconcile-wo-parts
  7         3 enter-wo-update-data
  8         3 retrieve-wo-data
  9         3 report-wo-status
 10         3 close-out-wo
 11         3 process-lookup-table-data
 12         3 work-order-transfer
 13         3 generate-work-order-data
 14         3 edit-transactions
 15         3 enter-parameter-data
 16         3 update-internal-wo-files
 17      2 process-task-performance-data
 18         3 sample-task-performance-data
 19         3 report-task-performance
 20         3 distribute-tcf-data
 21         3 enter-task-perf-factor-adj
 22         3 task-perf-fact-adj-subp
 23      2 maint-parts-inventory
 24         3 inter-mgt-annot-shop-sup-list
 25         3 annotate-repair-parts-form
 26         3 enter-shop-supply-data
 27         3 print-part-number-mismatch-lst
 28         3 print-reconciltn-excptn-report
 29         3 print-shop-stock-list
 30         3 print-ssl-constrnt-list
 31         3 print-ssl-locator-list
 32         3 print-supply-activity-reqmnts
 33         3 print-supply-reports
 34         3 print-zero-balance-stock-list
 35         3 record-parts-status-on-rpf
 36         3 record-received-parts
 37         3 generate-monthly-report
 38         3 print-error-exceptn-report
 39         3 generate-mpom-transfer-file
 40         3 transmit-accptd-work-orders
 41         3 transmit-tech-labor-rpt-form
 42         3 parts-tracking-handling
 43         3 sort-repair-parts-forms-ind
 44         3 transmit-manual-requisition
 45         3 transmit-wo-rep-parts-form
 46         3 gen-parts-awaiting-disp-action
 47         3 gen-parts-status-detail-list
 48         3 gen-shopstock-zero-balance-rep
 49         3 gen-supply-activity-req-list
 50         3 xm-tab-dectbl-input-datacheck
 51      2 maint-equipment-data
 52         3 record-equip-inspec-data
 53         3 determine-required-maint
 54         3 process-equip-recall
 55         3 process-equip-evacuation
 56         3 control-float
 57         3 enter-equipment-usage-data
 58         3 print-equipment-usage-data
 59         3 process-equipment-usage-data
 60         3 proc-tbl-build-ecc-sta-sto-ing
 61      2 maint-personnel-data
 62         3 enter-personnel-data-changes
 63         3 print-work-center-summary
 64         3 output-magnetic-transfer-media
 65         3 print-labor-util-summary
 66         3 print-workload-status-age-rpt
 67         3 change-personnel-assignments
 68         3 change-toe-tda-authorization
 69         3 gen-labor-utilization-summary
 70         3 generate-work-center-summary
 71         3 updt-labor-utilization-detail
 72         3 xm-l-dectbl-input-datacheck
 73         3 process-wrk-ctr-lbr-edt-subp
```

Figure 3-4. Revised MOM High-Level Hierarchy

MOM structure and nomenclature as was consistent with the MPOM system requirements. Retaining this similarity improves the ability to describe inter-system communications (MOM to MPOM). Items found in the MOM but not in the MPOM are included and tagged with a "can't justify" memo.

The functional requirements hierarchy is the "backbone" of the LARE computerized databases for both requirement sets. It provides a concise view of the system functions and indicates groups of related functions. It aids communication between users and analysts. If a user's job is to manually process work orders and the analyst's job is to automate portions of the manual process, the user must communicate his/her job operations to the analysts. The analyst, after obtaining information about the process, develops a structure that reflects his/her understanding, then uses that structure to interact with the user. A user looking at the analyst's structure can readily see the misunderstandings or omissions. Figure 3-5 is a marked up structure report that resulted from a discussion between project personnel.

The functional structure is also useful for tying related requirements together. The MOM and MPOM specifications (like all specifications) spread related requirements throughout the document. Paging through a document manually to establish relationships between items scattered throughout multiple chapters and documents is time consuming and error prone. Maintaining these relationships manually in a dynamic environment is often overwhelming.

The LARE functional hierarchies of the MOM and MPOM (see Appendix D) represent our understanding of the two systems at a high level. The structure also assists communication among analysts on the project. Further it is the "skeleton" on which the system is built.

```
CADSAT Version  3.2R2                                   APR 21, 1981  20:40:32     page      1
                              LOGICON LEXINGTON VAX SYSTEM

                                    process structure

    parameters for: str

       process indent=3 noindex

   count level name

       1  3 enter-initial-wo-data
       2     4 enter-standard-wo-data
       3        5 assign-equip-recall-reqmnt-won
       4        5 assign-intra-shop-wo-numbers
       5        5 ent-assigned-work-order-number
       6        5 enter-work-order-task-data
       7        5 enter-wo-evacuation-data
       8        5 process-maintenance-request
       9        5 register-intra-shop-work-order
      10        5 enter-work-order-parts-data
      11           6 enter-wo-supplmntal-parts-data
      12           6 enter-wo-parts-reassignments
      13              7 re-assign-wo-parts
      14           6 xm-cp-dectbl-input-datacheck
      15           6 xm-cs-dectbl-input-datacheck
      16           6 process-edit-subprocess
      17        5 enter-registration-wo-data
      18           6 xm-a-dectbl-input-datacheck
      19           6 xm-p-dectbl-input-datacheck
      20           6 process-wo-registration-data
      21        5 enter-wo-requirements-data
      22           6 process-wo-requirements-tasks
      23     4 enter-production-wo-data
      24        5 ent-prod-program-mgmt-detrmn
      25        5 establish-maint-production-prg
      26        5 xm-g-dectbl-input-datacheck
      27        5 process-maint-prog-dat-inp-sub
      28     4 enter-alt-sro-data
```

Where is information about
Consumption data ?

Do you want to set up
a separate category
~~with~~ for consumption data ?

what about Labor and Parts ?
where are the decision checks ?

Figure 3-5. Example Process Structure with Comments

The LARE functional hierarchy remains the "backbone" and concisely states requirements (baseline) throughout the system development cycle.

The following analyses are based on the terminology developed in these hierarchies. An advantage of the computerized databases is that hierarchy can be readily changed to include results of further analysis. The systems analyst's reports or working papers can be reprinted to readily reflect any modifications.

3.5 Control Requirements Analysis

MPOM control flows were analyzed and represented in the LARE computerized database. The objective was to determine the sequence of functions in order to show functional consistency and to identify missing requirements. In a completely consistent system every functional requirement appears as a step in at least one control sequence, and every control sequence has at least one cause.

Control flow analysis of MPOM proved difficult due to numerous missing requirements. These gaps left the LARE representation incomplete. Given more time and access to users to clarify requirements, it would be possible to build a complete, consistent MPOM control flow.

We identified two major types of missing requirements: control sequence activation and system initialization. Many control sequences can be constructed, but the specification omits requirements or fails to state clearly how to start the processing. Potentially, processing

could be started by particular messages being input, by certain fields being present in input messages, by clock time, or by time relative to other processing.

All software needs procedures to load data and start operation. Information management systems like MPOM also need procedures either to build the initial database or to start operations using a database built externally. The MPOM specification lacks requirements addressing these subjects.

In some cases it was not possible to follow the control sequence through the system to an output. Conversely there were instances of outputs not tracing back to an input sequence. An example of the latter case appears in Annex H, Table 406 of the MOM. (See Figure 3-6) Sequence 2 prompts for "CRD-DSG." This element is not defined as an input to the Equipment Recall process (See Figure 3-6)

3.6 Data Requirements Analysis

MOM and MPOM data flows were analyzed and represented in LARE computerized databases. All data identified in the MPOM specification was named, structurally related to other data where appropriate, and tied to the computational processes. The MOM data structure is simpler, concentrating on the nature of the inputs and outputs. Our objectives were to identify redundancy, inconsistency and incompleteness in the data specification. In a completely consistent system every input datum should contribute to at least one output, and conversely, every output of the system should be derivable.

Originator: KJF
Verified by: KMT
Sent to AIRMICS:

DISCREPANCY REPORT

Source	Type of Discrepancy	Remarks
MOM	INCONSISTENT DATA	
ANNEX H DECISION TABLE 406 PG H-215 SEQUENCE 2		SEQUENCE 2 PROMPTS FOR 'CRD-DSG'. THIS ELEMENT IS NOT DEFINED AS AN INPUT TO THE EQUIPMENT RECALL PROCESS. (I2.30.KY) SHOULD IT BE 'CARD-DSG-CD-SAMS' (XME "B")?

Figure 3-6. Sample Discrepancy Report No. 1

Inputs and outputs for both the MOM and MPOM are detailed in Annexes. After loading data into the databases in a specific sequence, the Name-List Report was used to flag inconsistent nomenclature. Figure 3-7 shows actual listing in which inconsistent nomenclature between input and output elements surfaced. Another example in Annex B has an output (03 22 1Y) element referenced as P-WON. The corresponding input element defined in Annex A (I3 11 40) is P-WON-ORG. (See Figure 3-8). This type of inconsistency makes it difficult to identify instances of data 'used' but not "derived". Although inconsistent naming functions are thought of as clerical mistakes, they create nightmarish debugging problems if an output module expects P-WON and the input module defines P-WON-ORG.

In attempting to tie internally defined data with the data defined as inputs and outputs, the discrepancies multiplied. Internal data are defined by the specifications, especially in the decision tables. In a great many cases, the internal data could not be associated with the inputs or outputs by name. For example, Annex H of the MOM Table Number 1368, sequences 2, 3 and 6 prompt for DIC-SUP-ACT, we were unable to locate an input so defined. (See Figure 3-9). Furthermore, the specifications did not identify specific processing steps that would have allowed us to link the data or show that multiple naming had occurred.

When the specifications identified data characteristics (e.g. legal values) these were recorded in the LARE databases as attributes. When a piece of data had attributes already entered, LARE would flag attempts to enter new attributes of the same type. From this the analysts knew to check for consistency. Inconsistency does not automatically imply incorrect data, it must be checked by analysts. For example, MPOM input element END-ITEM-COMP-IND-FLD (Annex A, I3 01 8W FLD 3) is defined as alphanumeric. The only

```
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                                             name list

         name                                  type                synonym                        paragraph

                                                                   ost-cmpt                       m-b,o2.41.4y.fld.11
 525     odr-and-shipping-time-manager         element                                            m-b,o2.41.4y.fld.22
                                                                   oranshti                       m-b,o2.39.4m.fld.24
                                                                   ost-mgr                        m-b,o2.41.4y.fld.10
 526     old-part-number-field                 element             old-prt-no-fld                 m-b,o2.34.4y.fld.6
                                                                   olpanofi                       m-b,o2.34.4y.fld.6
 527     olpanufi                              *** undefined ***
 528     on-hand-qnty-orf                      *** undefined ***
 529     on-hand-qty-rep                       *** undefined ***
 530     on-hand-quan-op-read-float            element             onhand-qnty-orf                m-a,12.40.ky.fld.8
                                                                   onhaquopre                     m-a,12.40.ky.fld.8
 531     on-hand-quant-oper-read-flt           element             onhaquoprefl                   m-b,o2.10.4y.fld.7
 532     on-hand-quantity                      element             onhaqu                         m-b,o2.09.4w.fld.17
 533     on-hand-quantity-for-repair           element                                            m-b,o2.08.4m.fld.12
                                                                   onhand-qnty-rep                m-a,12.06.ky.fld.6
                                                                   onhaqufore                     m-a,12.07.8m.fld.11
 534     on-hand-quantity-repair-parts         element             onhand-qnty-rep-prt            m-a,12.17.ky.fld.20
                                                                   onhaqurepa                     m-a,12.17.ky.fld.20
 535     one-par-days-prts-stat-det            element                                            m-b,o2.30.4w.fld.5
 536     one-par-days-pts-status-detail        element             onpadapast                     m-a,12.98.fld.4
                                                                   parm-da-prt-sta-one            m-a,12.98.fld.4
 537     one-param-days-wo-age                 element             onpadawoag
 538     one-parm-days-field-wo                element             onpadafiwo
 539     one-parm-days-range-fld-wo-age        element             onpadarafi                     m-a,12.98.ky.fld.5
                                                                   parm-da-rng-wo-age-one         m-a,12.98.ky.fld.5
 540     onhand-qnty-rep-part                  element                                            m-b,o2.42.4y.fld.29
                                                                                                  m-b,o2.33.4y.fld.6
                                                                                                  m-b,o2.41.4y.fld.26
                                                                                                  m-b,o2.39.4m.fld.13
                                                                                                  m-b,o2.42.4y.fld.27
                                                                                                  m-b,o2.42.4y.fld.25
                                                                                                  m-b,o2.42.4y.fld.23
                                                                                                  m-b,o2.42.4y.fld.21
 541     onhand-quantity-orf                   element             onquor
 542     op-readiness-float-item-desc          entity              opreflitde                     m-4.13
 543     open-supply-transactns-report         output              opsutrre                       m-b,o2.36.4w
 544     open-work-orders-report               output              opworre                        m-b,o2.06.4w
 545     optional                              attribute-value     opt
 546     ord-date-stat-chg                     *** undefined ***
```

Figure 3-7. Example Name-List

Originator: JAM
Verified by: KJF
Sent to AIRMICS:

DISCREPANCY REPORT

Source	Type of Discrepancy	Remarks
MPOM	INCONSISTENT DATA	
03.23.1Y XMJ ANNEX B PG B-59 I3.11.4D XMJ INPUT PG A-49	FIELD #2 IS OUTPUT AS P-WON BUT INPUT AS P-WON-ORG.	ARE P-WON-REFERENCES SYNONYMOUS?

Figure 3-8. Sample Discrepancy Report No. 2

Originator: KMT
Verified by:
Sent to AIRMICS:

DISCREPANCY REPORT

Source	Type of Discrepancy	Remarks
MOM	QUESTION	
ANNEX H TABLE NO. 1368 PG H-640 SEQUENCES NO. 2,3,6		WHY IS THE "DIC-SUP-ACT" BEING PROMPTED? WE WERE UNABLE TO LOCATE THAT ELEMENT. SHOULD THIS BE "SUPPLY SUPPORT ACTIVITY NUMBER" (SUP-SPT-ACT-NO) M-ØØ1Ø-Ø1?

Figure 3-9. Sample Discrepancy Report No. 3

legal values are alphas. This is inconsistent but not necessarily illegal as far as the system is concerned. (See Figure 3-10).

Data analysis identified other problems worthy of attention. One is redundancy. Instances of duplication were found where different users defined the same input in several ways. Other data structures which appeared dissimilar on casual inspection were shown by LARE reports (Consist/Compare Report) to consist of identical components. (See Figures 3-11). Inputs and outputs that appear similar could be identical if data components with slightly different names are in fact identical. Reducing redundancy cuts storage and processing costs, and increases target system efficiency.

The Consists Comparison Report provides visibility into the impact of certain changes. For instance changing the "part-number-field" from a numeric to an alpanumeric would impact, at a minimum, the circled items on the matrix report. (See Figures 3-11).

Another problem is the specification of design approaches - not requirements - which imply inefficient when implementation. For example, the Supply Status File for MPOM is sorted on each update and sorted again for each use. Sorting is a time consuming process which should be minimized to increase processor availability. This may be accomplished in the example case by carefully choosing the occasion for sorting and perhaps by trading off some storage in which to save secondary sort keys. Further, sorting of new updates, followed by a merge with previous data would reduce processing time.

Originator: JAM
Verified by: KJF
Sent to AIRMICS:

DISCREPANCY REPORT

Source	Type of Discrepancy	Remarks
MPOM	INCONSISTENT DATA	
ANNEX A I3.Ø1.8W.WOR FLD 3 PG A-14	CONFLICTING FIELD TYPE AND VALUES FOR END-ITEM-COMP-IND-FLD.	FIELD TYPE IS ALPHA-NUMERIC, BUT THE ONLY LEGAL VALUES ARE ALPHA (E OR C). SUGGEST FIELD TYPE OF "ALPHA" FOR THIS FIELD.

Figure 3-10. Sample Discrepancy Report No. 4

```
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                                LOGICON LEXINGTON VAX SYSTEM

                                 consists comparison report

basic contents matrix

the rows are the given input names.

the columns are the lowest level objects which are
contained in the rows, with intermediate groups ignored.

if any columns are group names, then the
definition is incomplete.

if any columns are ambiguous names, they are possible elements.


  row names                                                  column names

 1 alt-sro-requirements              input                   1 unit-id-code-support-unit       element
 2 bench-stock-data-record-xm-pd     input                   2 unit-id-code-customer-unit      element
 3 bench-stock-data-record-xm-pe     input                   3 modification-number-field       element
 4 bench-stock-data-record-xm-pf     input                   4 modification-wrk-ord-prio-cod   element
 5 bench-stock-data-record-xm-pq     input                   5 itnoitnofi                      element
 6 calibration-req-by-customer       input                   6 itnoitnofi                      *** undefined ***
 7 calibration-required-by-item      input                   7 part-number-field               element
 8 calibration-work-order            input                   8 equip-serial-lcl-con-no-fld     element
 9 cross-reference-transaction       input                   9 registration-serial-number      element
10 eqreneita                         input                  10 recall-avail-date-ordinal       element
11 equipment-recall-new-item-a       input                  11 procurement-req-ord-number      element
12 equipment-recall-new-item-b       input                  12 documentation-identifier-code   element
13 equipment-recall-require          input                  13 file-input-action-code          element
14 float-file-adjustment             input                  14 card-designator-code-sams       element
15 maint-prog-data-record            input                  15 activity-address-code           element
16 maint-prog-reqmnts-data-record    input                  16 funds-available-designator      element
17 param-workload-backlog-age        input                  17 issue-priority-designator       element
18 parameter-duty-hours-rec          input                  18 account-processing-field        element
19 parameter-nors-norm-rec           input                  19 project-code                    element
20 parameter-parts-status-detail     input                  20 condition-desig-conus-location  element
21 parameter-previous-cycle-rec      input                  21 identifying-number-code         element
22 parameter-report-control          input                  22 item-noun                       element
23 part-number-change-data-rec       input                  23 routing-identifier-code         element
24 parts-receipt-data-record         input                  24 signal-code                     element
```

Figure 3-11. Example Consists Comparison Report - Part I

```
CADSAT Version  3.2R2                                      MAR 23, 1981  12:02:15      page     16
                             LOGICON LEXINGTON VAX SYSTEM

                              consists comparison report

basic contents matrix

                                                                                                                1
            1 1111111112 2222222223 3333333334 4444444445 5555555556 6666666667 7777777778 8888888889 9999999990
    1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890
   +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
 1 I**********I*         I          I          I          I          I          I          I          I          I
 2 I      *   I *********I**********I*         I          I          I          I          I          I          I
 3 I      *   I ****     I*       * I *        I          I          I          I          I          I          I
 4 I          I *********I          I          I          I          I          I          I          I          I
 5 I      *   I ***      I*         I  *       I          I          I          I          I          I          I
   +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
 6 I**   **   I          I*         I   *******I***       I          I          I          I          I          I
 7 I**    *   I          I*         I   **** **I***       I          I          I          I          I          I
 8 I          I          I          I          I    *     I          I          I          I          I          I
 9 I*         I ****  *  I          I    *     I     **** I          I          I          I          I          I
10 I**     *  I          I          I     *   *I*        *I***       I          I          I          I          I
   +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
11 I**    *   I ***      I*         I     *   *I          I****      I          I          I          I          I
12 I     ***  I ***      I*         I          I  *       I    ****  I          I          I          I          I
13 I**    *   I          I*         I     *   *I* *       I********* I          I          I          I          I
14 I*     *   I **       I*         I          I          I         *I*****     I          I          I          I
15 I          I **       I          I          I          I          I     *****I******    I          I          I
   +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
16 I**   **   I      *** I*         I    *     I          I*     **  I          I * *******I****      I          I
17 I*         I ***      I          I          I          I          I          I          I    ***** I          I
18 I*         I ***      I          I          I          I          I          I          I         *I          I
19 I*         I ***      I          I          I          I          I          I          I          I***       I
20 I*         I ***      I          I          I          I          I          I          I          I   ***    I
   +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
21 I*         I ***      I          I          I          I          I          I          I          I      *** I
22 I*         I ***      I          I          I          I          I          I          I          I*        *I
23 I*         I *        I          I          I          I          I          I          I          I          I
24 I      *   I ** *     I*       * I          I          I          I     **** I          I          I          I
25 I      *   I ****     I*         I          I          I          I          I          I          I          I
   +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
```

Figure 3-11. Example Consists Comparison Report - Part II

```
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                              LOGICON LEXINGTON VAX SYSTEM

                                consists comparison report

contents similarity summary

row# name                                            row# name

   4 bench-stock-data-record-xm-pf    is a subset of      2 bench-stock-data-record-xm-pd
  89 xm-zb-dectbl-input               is a subset of      2 bench-stock-data-record-xm-pd
   3 bench-stock-data-record-xm-pe   is equivalent to    31 shop-stock-adj-data-record-b
  89 xm-zb-dectbl-input               is a subset of      3 bench-stock-data-record-xm-pe
   4 bench-stock-data-record-xm-pf    is a subset of     30 shop-stock-adj-data-record-a
  89 xm-zb-dectbl-input               is a subset of      4 bench-stock-data-record-xm-pf
  89 xm-zb-dectbl-input               is a subset of      5 bench-stock-data-record-xm-pa
   7 calibration-required-by-item     is a subset of      6 calibration-req-by-customer
  89 xm-zb-dectbl-input               is a subset of      9 cross-reference-transaction
  38 table-build-data-rec-xm-ya       is a subset of     11 equipment-recall-new-item-a
  89 xm-zb-dectbl-input               is a subset of     11 equipment-recall-new-item-a
  89 xm-zb-dectbl-input               is a subset of     12 equipment-recall-new-item-b
```

Figure 3-11. Example Consists Comparison Report - Part III

3.7 Requirement Traceability

Prior to a detailed review of MOM and MPOM specifications, it was thought that the MOM specification was a more detailed discussion of the MPOM system. Close examination showed that although many processing functions are the same, MOM and MPOM support different levels of Army maintenance management. These systems transfer information back and forth and must therefore be capable of interfacing. But requirements traceability as such was not possible. It is discussed here in the abstract because it is felt to be a key issue in the development and maintenance of complete/consistent specifications.

One objective of this study was to demonstrate the applicability of LARE to Army system specifications. What follows is a discussion of how requirements traceability is done. Several sample reports have also been included.

Most large systems have a hierarchy of documentation or specifications. Generally, the following types of information can be found:

- User notes, letters, concept papers -- proposals to support the initial systems engineering
- User requirements document -- statement of the system requirements from the user perspective
- System functional requirements document -- the general functional system requirements (GFSR) in Army nomenclature

- Detailed functional requirements document -- the detailed functional system requirements (DFSR) in Army nomenclature

- System test requirements -- the set of requirements for system testing prior to the government agency accepting delivery.

- System design specification -- detailed description of the system architecture (hardware and software) which will be built to meet the system required capability

- *Hardware layouts and prints, or software listings*

Many problems of system development and maintenance can be avoided by clearly documenting system requirements traceability. Development is improved because all requirements end up in hardware or software implementation and all key requirements get tested prior to system acceptance. Following the requirements from the top level all the way down to the hardware prints or software listings achieves traceability.

System maintenance (changes to the system as requirements change) can cost less. All too frequently, system failure results when the obvious changes are made in software modules. Good requirements traceability documentation clearly aids identification of all necessary changes, not just the obvious ones. LARE helps by listing closely related requirements, the analyst determines the necessary changes.

An example of a typical requirements traceability report is shown in Figure 3-12. The report is printed showing traceability from a higher-level to a lower-level specification (traceability between any two separate databases). The report automatically prints the traceability from the lower level to the higher level. It also lists requirements which exist in the specifications but which are not found in the databases and lists requirements for which there is no traceability in either direction.

3.8 Consistency and Completeness Analysis

Inconsistency or incompleteness of requirements is found by performing the tasks described in the preceding paragraphs. Rather than scatter the discussion a separate subsection summarizes and discusses the problems. While this analysis identified numerous problems, the analysis has been kept superficial to demonstrate the applicability of the technology rather than to exhaustively identify problems.

Tables 3-1 and 3-2 summarize:

- types of discrepancies
- LARE reports which aided discrepancy identification
- tally of discrepancies formally written-up

3.9 Requirements Specification Generation

A sample of text printed by LARE is shown in Figure 3-13. The statements or paragraphs of individual requirements are much shorter

INCONSISTENT DATA		INCOMPLETE DATA	QUESTIONS/OBSERVATIONS	TYPOGRAPHICAL ERRORS
		Missing Information:	Regarding:	
Inconsistent:	Duplicated:	Fields:	Design:	
dic code field label references format element names mnemonic field length field name definition field type title name media	names subprocesses sources numbers pages Conflicting: title page/page content output values Missing: outputs inputs references cross references source numbers field checks alphabetical sequence	references significance field checks xm code elements Design: customer priority processing soft criteria information entry rules value change checks error code numbers initialization data General: fields titles contract sheets prompts numbers numbers pages tables element names	legality range value max pgs loading transactions system limits p-won constructs flow charts Files: temporary files file name changes Duplication: duplicate inputs multiple field use duplicate elements Process: total number days error codes prompts reference calculations deletions sort field number change Reports: print reports name conventions report distribution element differs	Typographical errors though present were not noted. (Some typographical errors, were written up as samples.)

Table 3-1. Discrepancy Reports Breakdown

Report Names	Inconsistent Data	Incomplete Data	Total
Namelist Report	20	11	31
Structure Report	19	10	29
Process Chain Report	6	6	12
Consist-Compare Report	10	7	17
Content Report	20	5	25
Name Generation Report	15	6	21
Formatted Problem Statement Report	18	5	23
Process Chain Report	7	2	9
	115	52	167

*There were also 79 Discrepancy Reports labelled Observations/Questions and 4 labelled typographical errors, making a total of 250 Discrepancy Reports.

Table 3-2. LARE Reports Offering Most Visibility into Problems that were Recorded on Discrepancy Reports.

3A PROGRAM   LOGICON REQUIREMENTS TRACEABILITY REPORT   11-FEB-80   PAGE 1

DATA BASES TRACED:
e3amsiss TO radar

DB1-REF	REQUIREMENT NAME	DB2-REF	REQUIREMENT NAME
m-3.1	dedicated-air-operation	r-1.2.a	air-surveillance-type-II
m-3.1	dedicated-air-operation	r-3.1.1.1.2.1	
m-3.1	dedicated-maritime-operation	r-3.1.1.1.2.2.5.1.b	py-ms-surveillance-volume
m-3.1	dedicated-maritime-operation	r-3.1.1.1.2.2.5.1.b	ms-detect-maritime-targets
m-3.1	dedicated-maritime-operation	r-1.2.b	maritime-surveillance-type-viii
m-3.1	dedicated-maritime-operation	r-3.1.1.1.2.2.5.1	maritime-surveillance-type-viii
m-3.1.1.1.1	py-clear-and-ecm-environments	r-3.1.1.1.1.e	py-as-non-ecm-environment
m-3.1.1.1.1	py-clear-and-ecm-environments	r-3.1.1.1.1.f	py-as-ecm-environment
m-3.1.1.1.1	py-clear-and-ecm-environments	r-3.1.1.1.1.e	py-as-non-ecm-environment
m-3.1.1.1.1	py-clear-and-ecm-environments	r-3.1.1.1.1.f	py-as-ecm-environment
m-3.1.1.1.1.a	dedicated-air-operation	r-1.2.a	air-surveillance-type-II
m-3.1.1.1.1.a	dedicated-air-operation	r-3.1.1.1.2.1	
m-3.1.1.1.1.c	dedicated-maritime-operation	r-3.1.1.1.2.2.5.1.b	py-ms-surveillance-volume
m-3.1.1.1.1.c	dedicated-maritime-operation	r-3.1.1.1.2.2.5.1.b	ms-detect-maritime-targets
m-3.1.1.1.1.c	dedicated-maritime-operation	r-1.2.b	maritime-surveillance-type-viii
m-3.1.1.1.1.c	dedicated-maritime-operation	r-3.1.1.1.2.2.5.1	maritime-surveillance-type-viii
m-3.1.1.1.1.1.2	process-radar-returns	r-3.1.1.2.1.1	as-resolve-range-ambiguities
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	detect-and-report-air-targets
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-detect-range
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-report-range
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-detect-azimuth
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-report-azimuth
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-detect-elevation-angle
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-report-elevation-angle
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-detect-ecm
m-3.1.1.1.1.1.2	target-detection	r-3.1.1.1	as-minimize-effect-on-surv-vol
m-3.1.1.1.1.1.2.a.1	py-air-surveillance-volume	r-3.1.1.1.1.1.c	py-as-surveillance-volume
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	detect-and-report-air-targets
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-detect-range
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-report-range
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-detect-azimuth
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-report-azimuth
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-detect-elevation-angle
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-report-elevation-angle
m-3.1.1.1.1.1.2.a.1	position-antenna-beam	r-3.1.1.1	as-detect-ecm

Figure 3-12. Example Requirements Traceability

than in the original specification. This is consistent with the recommended LARE methodology; each numbered paragraph must impose a requirement. Most paragraphs in the original specification contained multiple requirements.

Additional elements of the methodology, not used in this effort, provide editing of the text statements, automatically record changes in requirements and create a history file of previous requirements statements. The facility assists system configuration control and flags requirements which have changed since the analyst's last reading of the document. An example format used by Logicon for the Air Force's Joint Surveillance System (which required this capability) is shown in Figure 3-14.

3.10 Evaluation of Alternative Methodologies

Three requirements analysis methodologies were selected for a cursory comparative evaluation: LARE, SREM, and IORL. A brief overview is included to provide the reader a context for the comparative discussion.

LARE is a methodology built around Logicon's extended CADSAT. As stated earlier, LARE evolved from the University of Michigan's Problem Statement Language (PSL)/ Problem Statement Analyzer (PSA). In addition, LARE includes the Functional System Simulation Data Processing System (FSDPS) which assists system feasibility analysis and performance estimation. An overview of the LARE computerized support is shown in Figure 3-15.

2.1.1
For the MOM: Functional collector -- see data below.

2.1.1.1
For the MOM: For each item in Equipment Recall Requirements, a WON shall be automatically assigned.

2.1.1.2
For the MOM: the Shop Office Clerk shall register an additional Intra-Shop wo, using the next alpha I/S code to the WON. The WON sequence number remains constant, keeping intra-shop WO's together.

2.1.1.3
For the MOM: Maintenance Control Numbers with a start date within 90 days shall enter an assigned work order number on the TPR and WORF.

2.1.1.4
For the MOM: The Shop Office Clerk shall key for entering task data entry. When processor prompts, task requirements data shall entered.

2.1.1.5
For the MOM: The Shop Office Clerk shall enter Evacuation Data on the WO for higher level maintenance.

2.1.1.6
For the MOM: The Shop Office Clerk shall process customer maintenance requests.

2.1.1.7
For the MOM: The Shop Office Clerk shall register additional intra hop wo's and assign the next alpha intra shop code to the WON.

2. 8
r the MOM: The Shop Office Clerk shall enter work order parts data.

2.1. .8.1
For the MOM: The Shop Office Clerk shall enter supplemental work order parts data when the Repair Parts form requires supplemental parts that are on hand. Copy 3 of the Work Order Supplemental Parts Request shall be used for the entry.

2.1.1.8.2
For the MOM: The Shop Office Clerk shall enter wo parts reassignments, causing transfer to the TPR file.

2.1.1.8.2.1
For the MOM: There shall be reassignment of parts from one wo to another.

2.1.1.9
For the MOM: The registration of work order data is accomplished by the input of DIC XMA and DIC XMB (Work Order Registration Data).

2.1.1.10
For the MOM: Text to be determined.

2.1.1.1
For the MOM: There shall be entry of wo requirements data for task, parts, or supplemental parts data in real-time to the TPR.

Figure 3-13. Sample of LARE Generated Text - Format

LOGICON EXTENDED CAUSAT DATE 03/15/78 1015.2 est Wed PAGE 38

JOINT SURVEILLANCE SYSTEM REQUIREMENTS LIST (JRL)

REQ-NO	USERS	STATEMENT OF REQUIREMENTS	NREV	CREF SOURCE	SEGMENT SPEC
jrpa-780	A,C,US	Preserve at the simulation console positions the display and operator interaction capability available at standard operating positions.	0	a-jrpae-7 o-5.3.2.2.12	r-3.7.1.2.10.1.6
jrpa-790	A,C,US	Provide the capability for simulation operators to start, stop, advance and monitor external simulated data/inputs.	0	a-jrpae-9 o-5.3.2.2.12	r-3.7.1.2.9.2.3.6 r-3.7.1.2.9.2.3.b r-3.7.1.2.9.2.3.d
jrpa-800	A,C,US	Provide the capability for the simulation control consoles to input and alter specific Mode 2, 3, 4 and C responses simulated tracks.	0	a-jrpae-10 o-5.3.2.2.12	r-3.7.1.2.9.2.3.c
jrpa-810	A,C,US	Provide the capability for the simulation control consoles to enter simulated height on SIM flights for which mode C and/or previous simulated height is not available.	0	a-jrpae-11 o-5.3.2.2.12	r-3.7.1.2.5.4.3
jrpa-820	A,C,US	Provide the capability during a SIM/LIVE (mixed) environment to limit or exclude live data to specified console positions.	0	a-jrpae-13 buc-x	r-3.7.1.2.10.1.b
jrpa-830	A,C,US	The capability during the conduct of live exercises to ensure the safety of all aircraft through the use of Positive Target Control (PTC).	0	a-jrpae-14 o-5.3.2.2.12.4 c-57	r-3.7.1.2.9.3.a
jrpa-840	A,C,US	Provide the capability to assign a PTC team with the following data routed to the consoles: IFF data with Predesignated Mode 3 exercise codes, exercise flight plans, exercise tracks and, track data on tracks initiated by target monitors.	0	a-jrpae-15 o-5.3.2.2.12.4 c-57	r-3.7.1.2.9.3.d
jrpa-850	A,C,US	Provide the capability to start (simulated) data (flight paths) by specifiying: the SRN, initial coordinates, heading, speed, altitude, and the specified type of sensor/strobe data.	0	a-jrpae-17 a-jrpae-21 o-5.3.2.2.12 buc-x	r-3.7.1.2.9.2.1.a
jrpa-860	A,C,US	The real time generated simulated flight path shall have the performance characteristics of the type aircraft being simulated.	0	a-jrpae-17 a-jrpae-21 o-5.3.2.2.12 buc-x	r-3.7.1.2.9.2.1.a
jrpa-870	A,C,US	Generate data for simulating input from and output to specific external agencies.	0	a-jrpae-18 c-48	r-3.2.1.9.1.4.e

Figure 3-14. Sample of LARE Generated Text - Format II

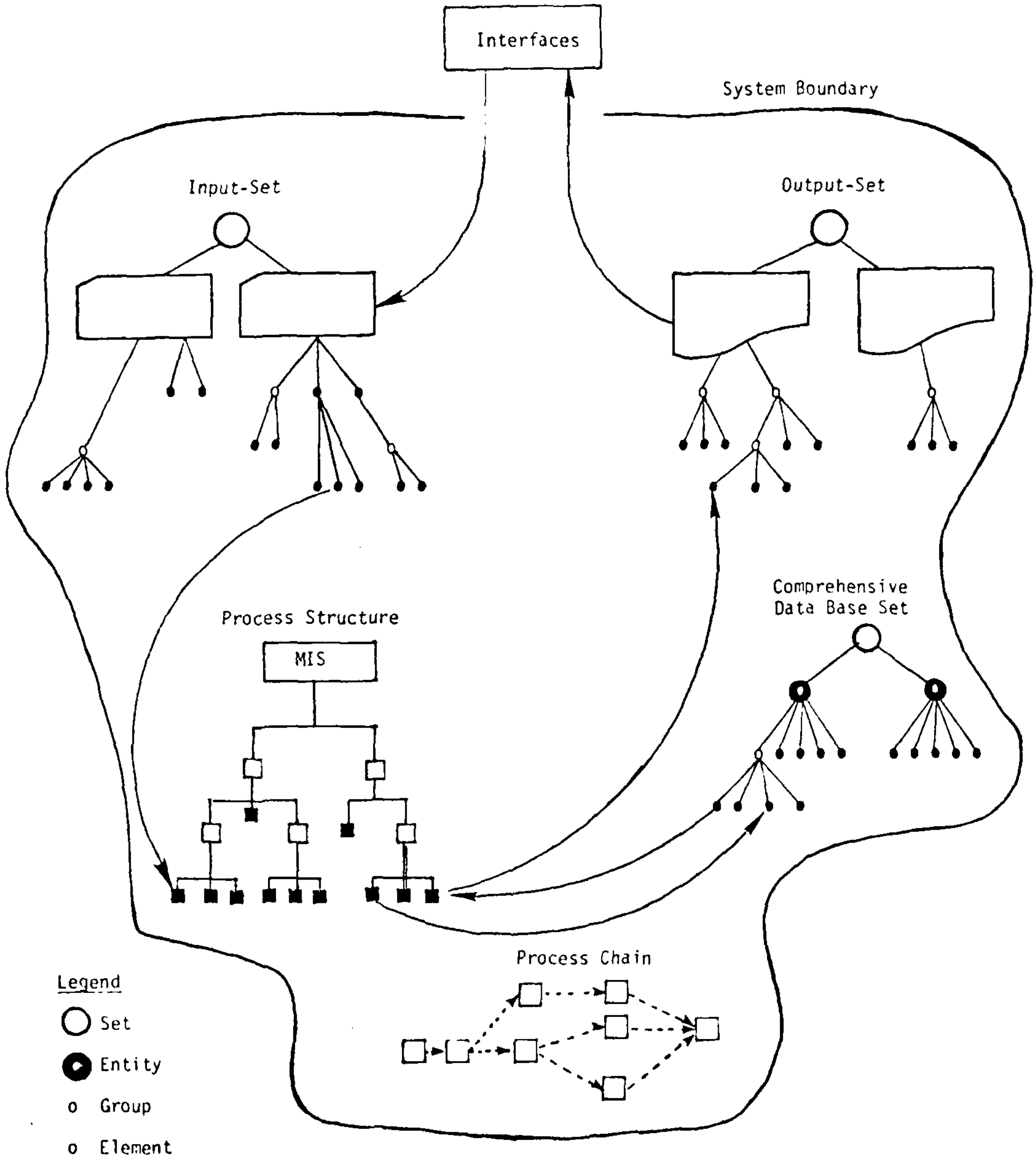


Figure 3-15. Schematic Diagram of CADSAT-Defined MIS, Structures, Control and Data Flow

SREM is a methodology built by TRW which uses computer assistance: Requirements Statement Language (RSL) and the Requirements Evaluation System (REVS). This tool also evolved from PSL/PSA. However, REVS moved much more radically from the standard PSL/PSA concepts. The only thing that remains is the Fortran data base management system (DBMS) at the heart of REVS. The input processors, analysis routines, and report generators have all been rewritten in Pascal. An overview of the functions and capabilities of REVS is shown in Figure 3-16. The REVS database containing the system description (defined by RSL statements) is called the Abstract, similar to the CADSAT or PSL languages but includes several enhancements (especially for representing functional flows - see Figure 3-17). One of the advantages of RSL is the ability to define or modify language constructs.

REVS appears capable of producing whatever outputs the user desires from any reasonable inputs. The user can perform either functional or analytical simulations. (This is the only tool reviewed which has an analytical simulation capability.) The difficulty for the user of REVS is that every module simulated must be described in Pascal statements and the user must write a driver in Pascal which simulates the external system environment. REVS provides three basic capabilities to support simulation: an executive controller, a set of simulation utilities, and automatically generated Pascal data descriptions for variables used by each module. The structure of the REVS simulator is shown in Figure 3-18.

Input Output Requirements Language (IORL) is supported by a system developed by Teledyne Brown Engineering. The language is not proprietary but the computer system processing the language is. The language may be described as a graphics language for describing either a set of system requirements or the actual system design. Functional interrelations are illustrated in Figure 3-19 and 3-20.

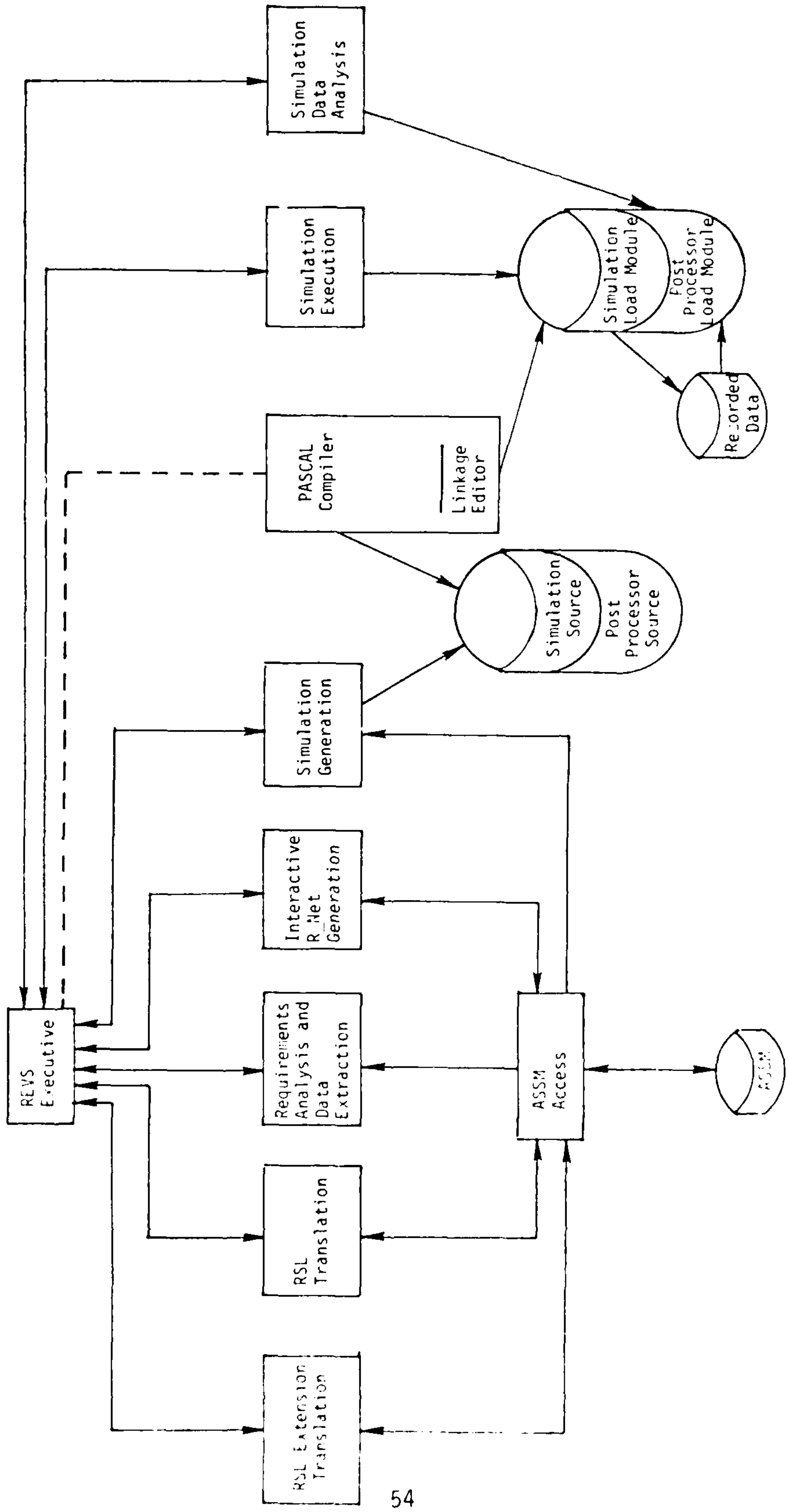
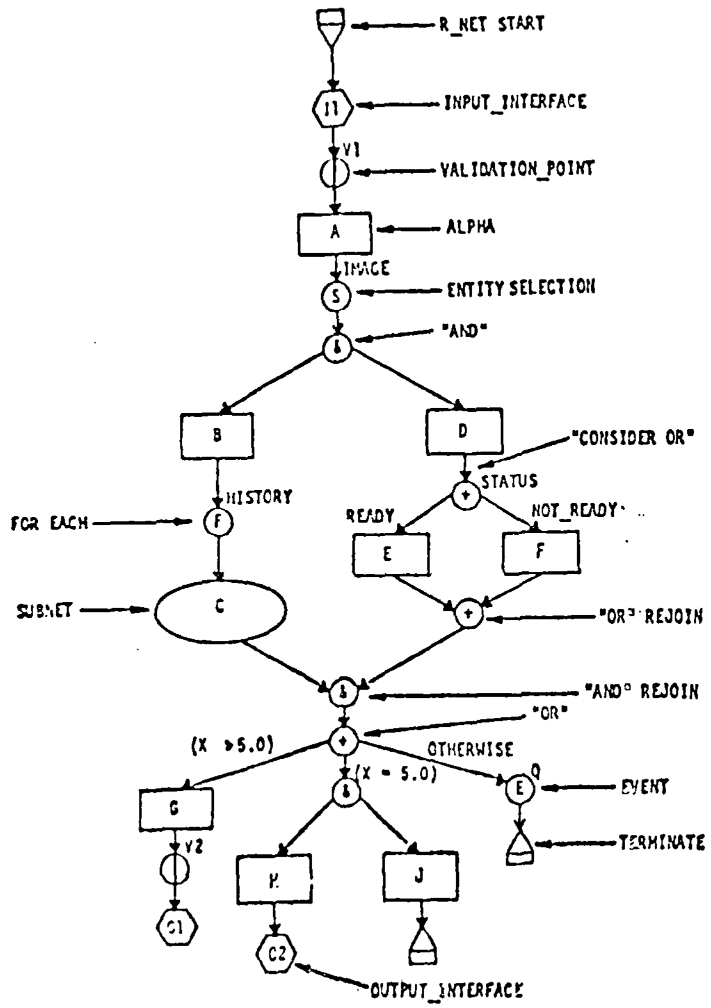


Figure 3-16. REVS Functional Organization




```
R_NET: SAMPLE.
STRUCTURE:
    INPUT_INTERFACE  I1
    VALIDATION_POINT  V1
    ALPHA A
    SELECT ENTITY_CLASS IMAGE SUCH THAT (Y < Z)
    DO
        ALPHA B
        FOR EACH FILE HISTORY RECORD
            DO SUBNET C END
    AND
        ALPHA D
        CONSIDER DATA STATUS
        IF (READY)
            ALPHA E
        OR (NOT_READY)
            ALPHA F
        END
    END
    IF (X > 5.0)
        ALPHA G
        VALIDATION_POINT V2
        OUTPUT_INTERFACE O1
    OR (X = 5.0)
        DO
            ALPHA H
            OUTPUT_INTERFACE O2
        AND ALPHA J
            ALPHA J.
            TERMINATE
    OTHERWISE
        EVENT Q
        TERMINATE
    END
END.
```

Figure 3-17. Sample R_NET Structure in RSL and in Graphical Form

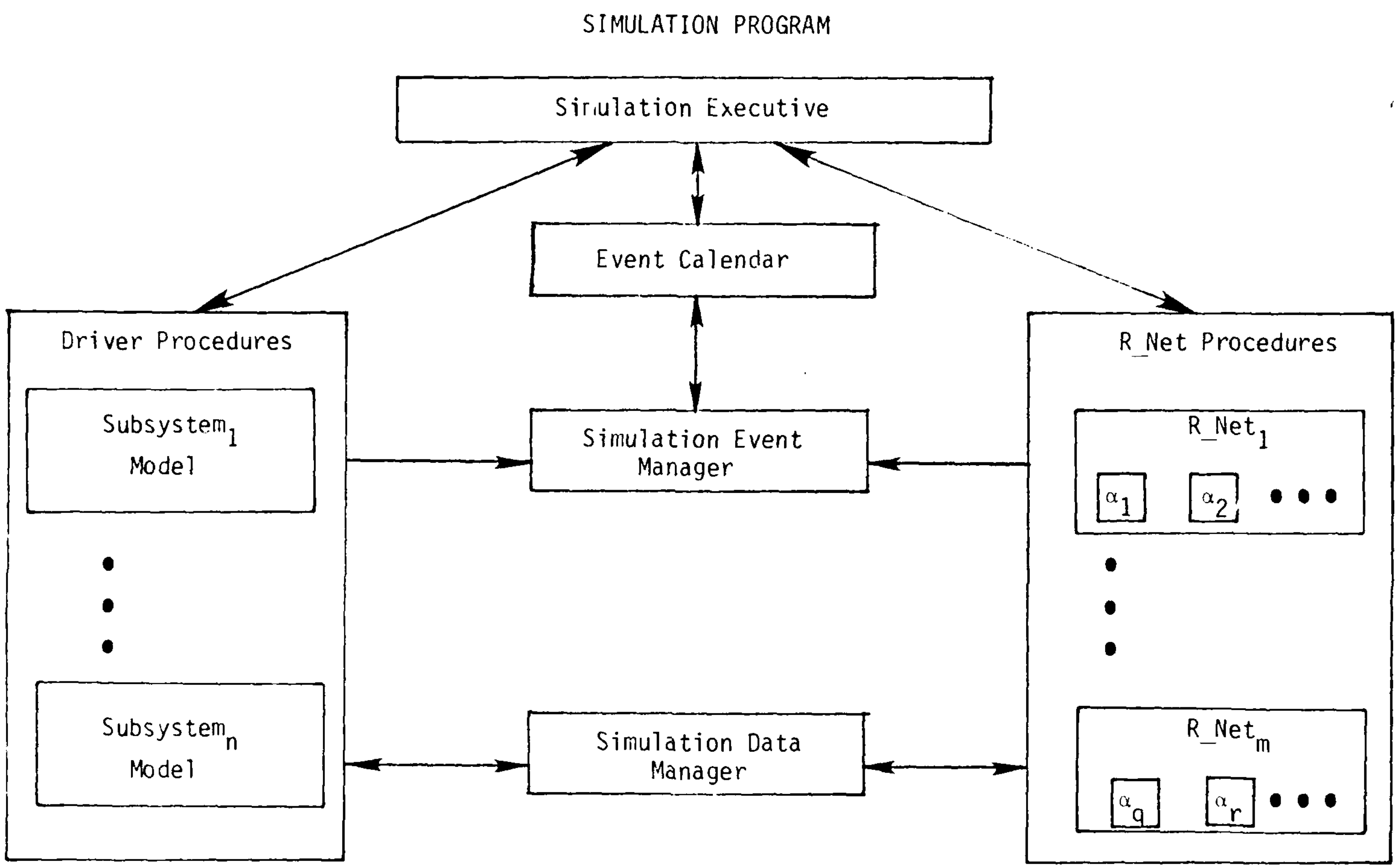


Figure 3-18. REVS Simulator Functional Components

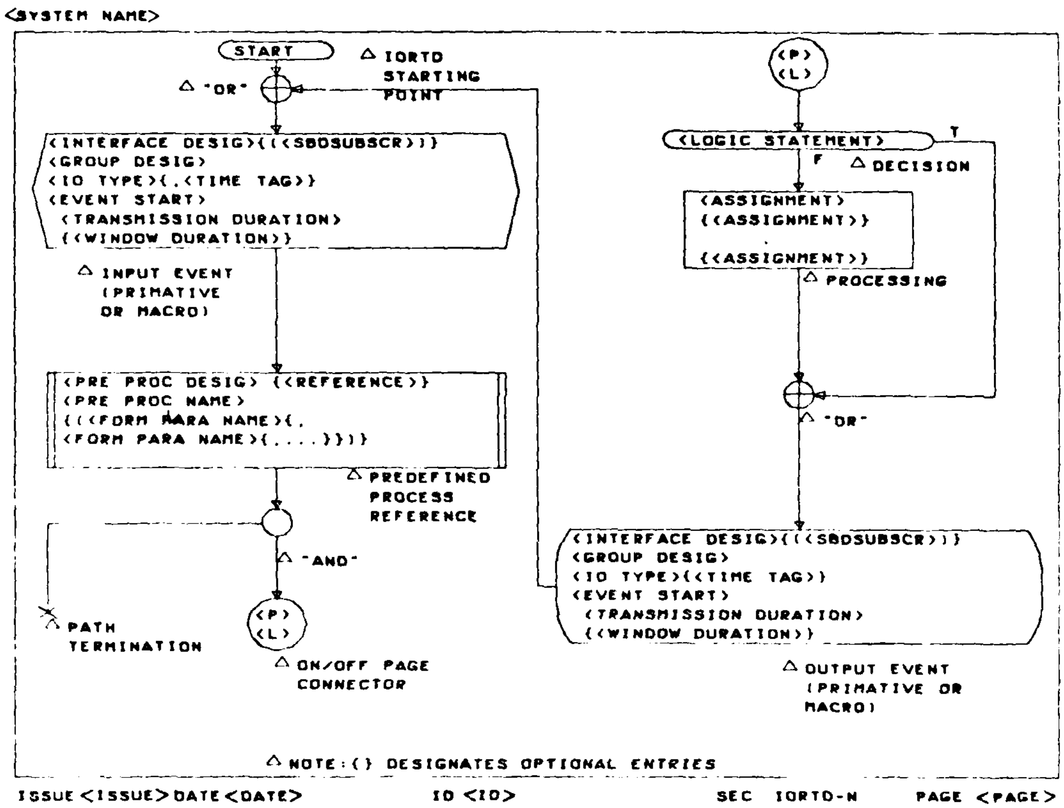


Figure 3-19. Functional Illustration of IORL

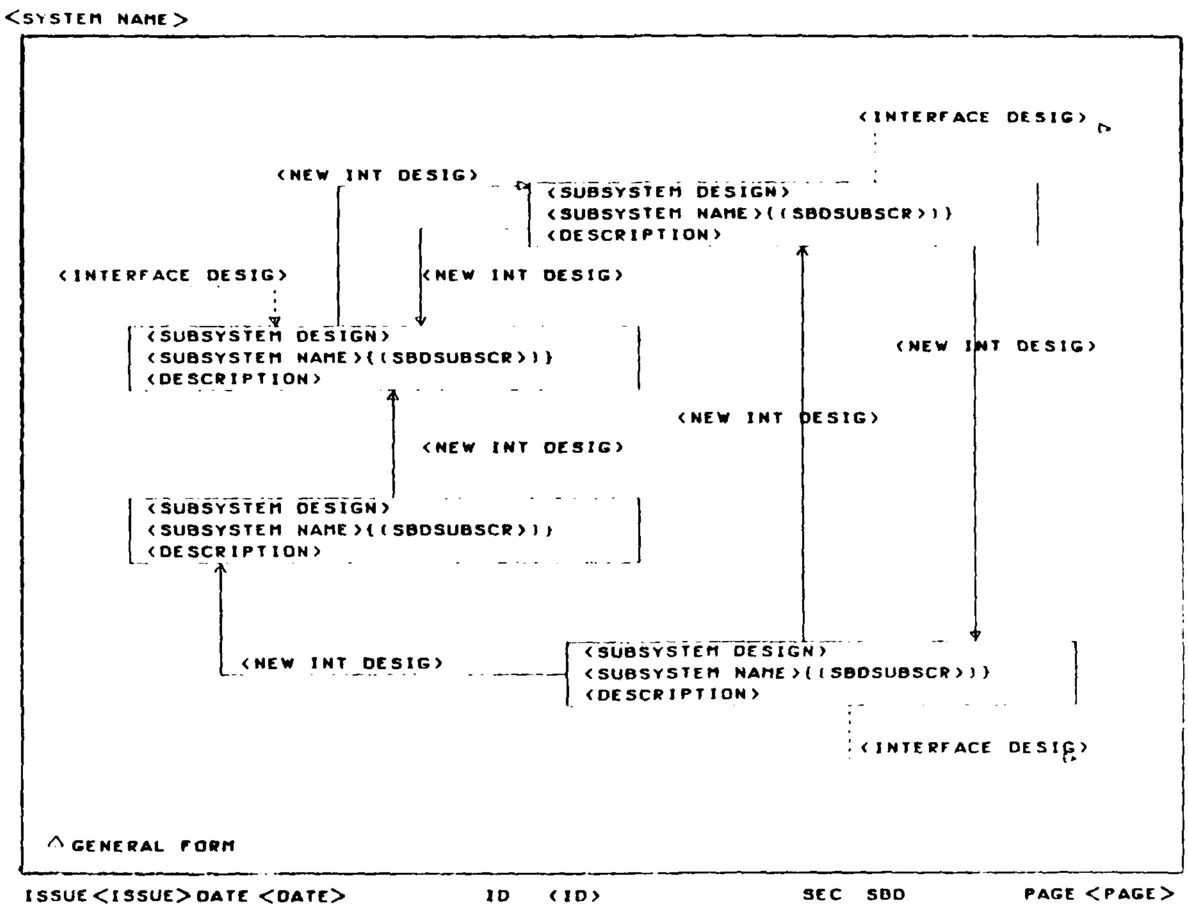


Figure 3-20. Illustration of IORL Schematic Block Diagram

Table 3-3 shows the individual ratings assigned to LARE, SREM and IORL with respect to the twenty-four categories listed. Categories were weighted equally. The overall rating is a simple average.

No distinction was made between tool performance in the various categories and the degree of human expertise required to achieve results.

While we recognize that this is an overly simplified approach, a more comprehensive evaluation was not within the scope of the project.

Recommendations to reduce LARE's cited weaknessess are discussed in Appendix C. All enhancements involve improvements in the presentation or display of information.

CRITERIA	LARE	SREM	IORL
	RATING		
Ease of:			
database modification	2	2	2
report generation	3	3	3
report readability	2	2	2
Ability to:			
record/depict functional requirements	3	3	3
record/depict constraint requirements	3	1	1
record/depict control flow	2	3	3
record/depict data flow	2	2	3
record/depict functional hierarchies	3	1	2
record/depict data hierarchies	3	1	1
record/depict interfaces	3	3	2
record/depict external documents	3	2	1
record/depict test requirements	2	1	1
record/depict project status	3	1	1
Ability to:			
aid in detection of incomplete data	3	2	1
aid in detection of inconsistent data	3	2	1
aid impact analysis	3	2	2
Ability to:			
generate system specifications	2	1	1
generate test specifications	2	1	1
generate design documentation	2	2	2
Ability to:			
simulate (general)	2	1	0
trace requirements	3	1	1
trace between levels of documentation	3	1	1
provide well-defined methodology	3	3	1
provide diagnostics	2	2	2
Totals	62	43	37
Overall Rating	2.58	1.79	1.54

Table 3-3. Evaluation Results

4. Conclusions and Recommendations

4.1 Conclusions Specific to this study

- This test program demonstrated that LARE can be applied to AIRMICS requirements. No technical barriers emerged, but some operational guidelines appear desirable. (These suggestions appear in the recommendations.)

- LARE's analytical effectivess came through clearly on this project. Over 250 discrepancies were found in the specifications. They were found by several people in a short period of time (6 months) who had no familiarity with Army specifications or with maintenance systems. In addition, there was no contact with the system users although some clarifications were requested from AIRMICS. The problems identified are presumably a small sample of those existing. Problem identification was only one objective. Much more of the effort was spent documenting the methodology and illustrating how the methodology can be applied.

- Review of alternative tools identified three key performance differences:

    - LARE provides the best overall requirements engineering support.

    - SREM offers the best functional flow presentation but focuses on describing system design rather than requirements.

- IORL displays the best graphics representation of requirements.

The cursory review permitted in a short time limits the conclusions to these first impressions. Comparison was further hampered by insufficient internal documentation and inadequate experience in applying these other tools.

4.2 Conclusions Supported by this Study and Prior Experience

4.2.1 Basis of the Conclusions. General conclusions are based on the results of this study and Logicon's experience over the past six years with computer aided requirements engineering and development of software tools to support analysis. Some LARE capabilities could not be demonstrated by this project, including: configuration control assistance, feedback to analysts, defining the system, and assistance in analyzing impacts of requirements changes.

Since LARE was shown to be effective and applicable to AIRMICS, Logicon's prior experience suggests that LARE could also effectively handle communications and weapons systems.

4.2.2 Assistance to Configuration Control. Configuration control of system requirements includes many things. One element is control of the statement of requirements and the republication of documentation. LARE assists this process. LARE enables changes in requirements to be flagged as either insignificant (correction of typos) or significant (change of the actual requirement or constraint). In addition, the technology provides an ability to move obsolete requirements to history files and to retrieve these requirements for analysis. If a particular

area of requirements changes too frequently, a more general analysis and change is probably warranted. Demonstration of this capability would have required a longer time period with an iterative interface with the user.

4.2.3 Feedback to Analysts. The general experience of human and computerized communications is that people think communication is taking place when it is not. A technique used to improve this situation is to provide feedback to the speaker or sender. In the case of human communications, it is not sufficient for the analyst to write a textual document of the requirements and ask the user to answer yes or no as to whether it accurately represents user requirements. Several approaches exist for improving this communication prior to the discovery that a system has been developed that fails to meet major "requirements". One technique currently being explored by AIRMICS is "system sketching" which builds rudimentary system capability to enable the user to operate on samples of real data to verify the desired capability. The viability of this approach depends on the ability to develop "quick and dirty" solutions considerably cheaper than the final production system. A second approach involves the use of LARE. The requirements are expanded in levels and the implied control and data relationships are explicitly identified so that the user can see more clearly how the analyst is interpretating the user's statement of requirements (verbal or written).

4.2.4 Simulation of Systems. System simulation is frequently necessary to show the feasibility of system development and to bound both costs and technology risks. A recent Logicon study (Integration of CADSAT (LARE) with General Purpose System Functional Simulation Technology, Contract F04701-77-C-0069) illustrated LARE's capabilities in this field (referred to as the Functional System Simulation Data Processing System (FSDPS)). It is a completely generalized simulator. Current internal Logicon efforts include research into driving this simulator directly from a LARE database.

4.2.5 Time of Application. This demonstration applied LARE to an existing set of requirements specifications. While it was said earlier that the application was successful, the results could have been even more beneficial had LARE been used from the beginning of the effort (during the development of the first drafts of the requirements specifications, including the General Functional System Requirements documents). While it is advantageous to apply LARE as early as possible, the reader should not conclude that there is ever a time for which the application is too late. Logicon has had application experience on other projects in which the systems had already been built and implemented prior to using LARE. In terms of the system life cycle, the majority of the system life is during the operations and maintenance phase. During this phase, considerable effort is expanded handling proposed requirements changes and attempting to determine the technical ramifications of these changes (what other requirements must change and how do these impact the implemented design).

4.2.6 Initial Planning of LARE Application. Another consideration is time. A month or two is needed for a single/couple of analyst(s) to sort through the requirements and develop a reasonable draft to the Requirements Engineering Plan. Analysts applied too soon in an uncontrolled manner contribute to poor results and a waste of time and money.

4.2.7 Time Required for Application. The effort should be more than six months of calendar time. The requirements definition phase generally takes place over a year or two and in some cases, several years. The issue is not one of putting enough people on the project but of having enough time for the analysts to think through the structural relationships of the requirements and get the appropriate reviews and feedback with the system user community.

4.2.8 Time Needed to Reorganize Database. Periodically, the requirements database needs to be reorganized. In the case of a requirements definition effort, the requirements expanding or the analysts' understanding of the requirements changing results in a need to modify the database. In the case of the analysis of existing specification, it becomes apparent that the functional breakout of the requirements is awkward and obscures relationships to the analyst and especially to the user. Time is needed for this reorganization. The ability to do this in a reasonably short period is one of the major advantages of having a computerized requirements specification. It should not be viewed by the analyst or management as a poor or inadequate job. The poor job is the failure to put effort into the reorganization when the methodology indicates it. The need for doing this type of iterative restructuring emphasizes the earlier point of having more than six months for requirements engineering.

4.2.9 Updating Capabilities. Many benefits of LARE were not realized or illustrated by this study because of the limited time period and scope. Much of the major effort of requirements engineering involves analysis of the problem and the loading of the initial databases. Once loaded, they provide an inexpensive and powerful capbility to attack problems during both the system development or operations/maintenance phases of the system life cycle. Also, as additional use is made of the databases, the analyst discovers requirement relationships not previously perceived. These new relationships are frequently the realization of the interdependency (if one requirement changes, the other is likely to change) between requirements rather than identification of new requirements. As these new relationships are discovered, they should be loaded into the database. Thus, the LARE database provides a "corporate memory" of all analytical experience with a particular system. This is especially advantageous to deal with system personnel changes. A set of manual notebooks maintained by individual analysts could not be integrated nor expressed in as uniform a fashion.

4.2.10 Analysis of Proposed Requirements Changes. Proposed requirements change impact analysis is a major area, often overlooked. People Logicon have spoken to have made the assumption that sufficient effort was going to be applied up front in order to eliminate the need for significant changes to the system. Our experience is that it is very unusual for the system to be implemented prior to major requirements changes. Two basic LARE capabilities lend themselves to this type of analysis: recording the interrequirements relationships within the computerized databases and reporting requirements traceability tracing the requirements from the top level requirements down to the individual hardware components, software modules, or personnel procedures.

4.3 Recommendations

- Improve LARE by incorporating the R_Net capability of SREM and augmenting the existing graphics capability with the use of IORL.

- Augment LARE's specification generation, data representation/display and information reporting capabilities in the areas detailed in Annex C.

- Apply the enhanced LARE to specify an Army system from initial requirements through implementation, using the following guidelines:

    1. Adequate time for initial requirements definition

    2. Develop a realistic Requirements Engineering Plan

    3. Require adequate "feedback" sessions between users and analysts

4. Allow time for reorganization of databases with respect to incorporating change

5. Simulate the proposed system

APPENDIX A
REQUIREMENTS ENGINEERING METHODOLOGY

A. INTRODUCTION

This Appendix details the requirements engineering plan used to analyze two Army Detailed Functional Specification Requirements (DFSR) specifications.

Each project must make decisions about which of the numerous LARE language features will best suit their individual needs. The main consideration in developing the AIRMICS specific plan was the determination of which LARE reports would best represent the information in the MOM and MPOM: and which reports would be used by analysts to detect problems. All of these decisions must be based on the goals and objectives of the project.

A.1 LARE Language Features. The specific language features chosen for this project are discussed at length in Appendix B. LARE is a language for describing system requirements and design. It is not a procedural programming language. It provides a capability for naming objects and providing textual descriptions of objects which play a role in the system. More importantly, it has the capability to define relationships among the objects and store/generate text associated with these objects.

Object names used in this application were: PROCESS, MEMO, INTERFACE, ATTRIBUTE, SOURCE, INPUT, OUTPUT, SET, GROUP, ENTITY, and ELEMENT. The main relationships used to describe the various aspects of the MOM and MPOM specifications were: RECEIVES, GENERATES (data across system boundaries), PART OF (system structure) CONTAINED IN, CONSISTS OF (data definition).

SYNONYMS, SOURCES, ATTRIBUTES and DESCRIPTIONS were used to reflect user-defined values and properties. Emphasis was placed on establishing a high level functional description of the system as well as the contents of the inputs and outputs used by the system.

A.2 LARE Report Features. There are three categories of reports/programs: application, update and utility. The application reports aiding Logicon analysts throughout this project are discussed briefly below and in detail in Appendix B. The update and utility reports are discussed only in this appendix.

A.2.1 Application Reports. The following reports were chosen to aid analysts in building the MOM and MPOM data bases:

DB Status (DBS)
Formatted Problem Statement (FPS)
Structure Report (STR)
Contents Report (CONT)
Name Generation (NG)
Name List (NL)

A.2.2 Database Update Programs/Reports. These programs enable the user to update the databases. The update programs commonly used on LARE-aided projects are:

- DELETE-PSL (DPSL)
  Deletes specific LARE relationships previously established in the database. A permanent record of the change is generated in the form of the deleted - LARE Report.

- INPUT-PSL (IP)
  Adds information to records in the database. A permanent record of the change can be generated in the form of the AS-IS Source Listing and Cross Reference.

- RENAME (REN)
  Changes a name or list of names in the database. The Rename Report establishes a permanent record of the change.

- DELETE (DEL)
  Deletes a name or a list of names from the database. When a name is deleted all of its connections to other names are deleted as well. A permanent record of the change is also generated in the form of the Deletion Report.

- PUNCH-COMMENT-ENTRY (PCOM)
  Produces a punch file used as an input file to RCOM and DCOM. It is used for changing and deleting textual database entries.

- REPLACE-COMMENT-ENTRY (RCOM)
  Replaces, for a given name, specific comment entries associated with the name. The Replaced Comment Entries Report records the change(s).

- DELETE-COMMENT-ENTRY (DCOM)
  Deletes, for a given name in the database, the specified textual entry associated with the name. The Deleted Comment Entries Report records the change(s).

A.2.3 Utility Programs. These programs are used by LARE software maintenance personnel to backup, maintain databases (errors are occasionally experienced by system crashes or sudden communications terminations.

- DB DUMP
  Dumps the contents of a database to the users' terminal showing pertinent information required for debugging any database problems. It provides a formatted dump of the internal database structue.

- DUMP
  Dumps a database, in a sequential file format for input to RESTORE.

- RESTORE
  To restore a previously dumped database. A database must be initialized before it can be restored.

- BCK
  Used to back up databases from disk to tape.

- RST
  Used to restore databases from tape to disk (previously backed by BCK).

A.3 Requirements Engineering Procedures. This section addresses why specific choices were made. Analysis, by definition, is an iterative process. Time constraints precluded multiple iterations. Decisions on how to best represent the data were made at the onset of the project. It was decided, for instance not to address the decision tables immediately. When they were addressed, it became apparent that the sheer volume and level of detail contained in them could be translated into LARE terms by example only. This is not to suggest that LARE cannot handle massive decision tables but that considerably more time would have been needed to make the conversion.

We decided to first concentrate on establishing a functional hierarchy of requirements for both the MOM and MPOM. This approach helps analysts working with an unfamiliar system towards an understanding of what the system is supposed to do. In addition, the functions provide the basic blocks or items, the objects for which the analyst must determine the interrelationships.

After agreeing on a structure suitable to both the MOM and MPOM, we diverged our emphasis. The MOM database was built to reflect inputs and outputs and the detailed elements contained in each. The emphasis was on Annexes A, B, and C of the MOM. We also loaded short textual statements that described the requirements as we determined them.

The MPOM database was taken several steps further. We established relationships in order to illustrate how LARE depicts control and data flows. This was in addition to information described with respect to the MOM database.

The Requirements Engineering Plan is dynamic in nature. As unique problems, specific to a project arise, they are evaluated and decisions about how to handle them are made. The plan must be updated accordingly to be an effective tool for the analysts.

Section A.4 is the plan given to project team members at the beginning of this study. It assumed, at a minimum, an existing understanding of LARE.

A.4 Procedures to be Followed on the Airmics Study Initial work on the Army specifications will concentrate on:

Reviewing Source Documentation

Identifying System Functions

Organizing Functions into a Hierarchical Structure

A.4.1 Reviewing Source Documentation. Two requirements databases will be initiated and developed, one for each specification. Read the main sections of the source documentation. Make notes about your concerns and questions. If further reading or referencing various annexes does not address your problem(s), then write up a Discrepancy Report detailing the problem and/or question.

Highlight what you consider to be system functions and other pertinent system information.

A.4.2 Identifying Functional Requirements Use PROCESS (PRC) to identify system functions in both the MOM and MPOM. The following procedures are to be conformed to when deriving the name of a function:

- no more than 30 alphanumeric characters in a name
- no abbreviations unless it is to stay under 30 characters
- no special characters in lead field of name
- no embedded blanks (separate the words in names with hyphens)
- whenever possible, start the name of a functional requirement with an action verb

The object is to concisely name the abstracted function. Examples of action verbs used in the past are:

annotate	forward
inspect	transfer
enter	sort
record	distribute
generate	retrieve
submit	notify
determine	

Whenever possible, avoid using LARE-reserved words as the first word in an analyst-assigned name.

Use SOURCE (SRC) to identify where in the MOM or MPOM specifications you are extracting your information. If the information comes from the MOM, use the prefix m- and the appropriate paragraph number. For source paragraphs from the MPOM, use the prefix p-. If annexes are b[illegible] referenced, use the appropriate lead prefix followed by th[illegible] a[illegible] letter. For example:

m-a-i2.Ø3.4D
p-p-03.Ø4.8W

The first example indicates that the information was found in the MOM, Annex A. The second example indicates the reference is in the MPOM, Annex B. Paragraph references rather than page numbers were chosen for the source references because they are less apt to change during any later expansions of requirements and provide more accurate references to the specific requirements.

A.4.3 Organizing-Functions Into a Hierarchical Structure As you are defining functions, logical groupings will begin to surface. Use the part of (PART) convention to identify PART/SUBPART relationships. Remember:

- a hierarchy of functions should provide a concise overview of what the system does (is to do)
- a hierarchy of functions is independent of system flow
- a hierarchy, in order to make sense, may have to include high-level collectors not specifically addressed in the user documentation (collectors are analyst invented names for groupings of required functions. Collectors aid organization of requirements)
- a hierarchy should contain no more than 4 to 7 discrete requirements under any given aggregate function

A.4.4 Analyze Control Requirements. Use the TRIGGERS (TRGS)/TRIGGERED BY (TRGD) language feature to establish the flow of control. TRIGGERS should be used to specify processing functions that necessarily follow one another.

Do not use the UTILIZES/UTILIZED By feature. Time and volume preclude accurately defining primary and secondary functions. Remember constraints:

- Primary function - a function which is part of the major mission, objective, or goal of the system. e.g., provide listing of all available equipment.
- Secondary functions - a function which by itself is not part of the mission of the system. e.g., provide building space to house personnel and equipment required for the maintenance of a data processing system.

A.4.5 Analyze Data Requirements. The input and output requirements of both the MOM and MPOM are detailed in Annexes A and B. Use the INPUT (INP)/OUTPUT (OUT) constructs to identify inputs and outputs. Whenever possible, use the names already assigned. Define the inputs and outputs in terms of the ELEMENTS that they contain.

Use the SET construct to collect inputs and outputs with multiple parts.

Load INPUTS and OUTPUTS identified in the text before loading the annexes. This will facilitate locating requirements called out in the text but not detailed in the input/output sections and vice versa. It will also help point to inconsistent naming conventions.

Employ the USES/USED BY construct to indicate how data is used within the system. RECEIVES/GENERATES should be used to indicate how the data enters the system and who/what receives the OUTPUTS. Define the who/what by the INTERFACE construct.

A.4.6 Analyze Requirements for Consistency and Completeness. This should be done at each step of the project. System completeness will be virtually impossible to determine. Concentrate on consistency checks. Use the Discrepancy Reports to detail instances of inconsistencies and information that you determine to be incomplete.

A.4.7 Load Text. This will be done after the hierarchy has been built. Generate a structure report with assigned references. Build a file using the DESCRIPTION (DESC) construct. Use the specification text that best describes the requirement. If multiple requirements exist in one paragraph, extract text which suitably and independently describes each function you have named. Do not load the entire paragraph every time it is addressed.

A.4.8 Use of the Computer Center. These procedures are to be followed by AIRMICS project personnel:

1) Each analyst is responsible for building his/her own input files. All input file names are to end in ".INP".

2) Proof your own files and submit to a second party for proofing before database updates are requested.

3) Databases are to be updated by the Project Manager only. If specific sequencing is required for inputs, specify a numeric order in the name. (i.e., xxx1.INP, xxx2.INP) Once a series of files is ready for loading, leave mail in the PM's directory indicating such.

4) Request report updates before running them. This will ensure that we stay within budget.

5) Databases will be backed up daily, so there is no need to clutter directories with unnecessary files. On-line storage is expensive!

6) Your AIRMICS' directories are to be used for project-related work only.

APPENDIX B
A DESCRIPTION OF THE LARE/CADSAT APPLICATION TO AIRMICS

B. INTRODUCTION. This appendix describes how Logicon has chosen to apply LARE to two Army DFSRs. Certain LARE terms (such as PROCESS, MEMO, TRIGGERS, etc.) which take on specialized meanings in this application, are discussed. More detailed information about LARE can be found in the documentation supplied by the University of Michigan (URL User's Manual, and URA User's Manual, Report No. ESD-TR-78-127, Volumes I and II).

B.1 Definition of LARE Terms

LARE terms used in this application are defined and explained in this section. Where abbreviations for terms are accepted by the LARE Programs, these abbreviations appear in parentheses following the names of the terms. A single sheet summary of the definitions and explanations is given in Table B-1, to assist the reader in recalling this information.

B.1.1 LARE Terms LARE names contain up to 30 characters with no embedded blanks; they represent objects in the CADSAT data base, such as PROCESSES, MEMOS or data aggregates. In this application, a name is commonly made up of several English words or abbreviations, separated by hyphens, to suggest the meaning of the object it represents.

B.1.2 PROCESS (PRC). A requirement is named as a process if it is a functional requirement, that is if it denotes an action which must be taken. Thus, for example, "process-work-orders" is named as a PROCESS.

PROCESSES are also used to "collect" non functional information represented in a specification. For example, chapters 1, 2, and 3 of the MOM and MPOM contain information about assumptions, benefits to be achieved, statutory and other regulatory requirements, etc. Paragraph reference numbers (sources) containing this type of information have been attached to "collectors". Examples of non-functional collectors are: header-only, non-functional-requirements, gfsr-assumptions, specific-dfsr-assumptions and safeguard-personal-data.

B.1.3 MEMO. A requirement is named as a memo if it can be stated as a constraint (such as sizing or timing). Whenever appropriate, a single

Table B-1. Summary of LARE Definitions

CADSAT Names:	Character strings up to 30 characters in length, English words or abbreviations from Table A-2 suggesting meaning, separated by hyphens
PROCESS:	Object naming a functional requirement - e.g., an action which must be taken
MEMO:	Object placing a constraint on a PROCESS or providing a description. MEMOS always apply to PROCESSES and must be so indicated on INPUT
SYNONYMS:	Given to all PROCESS, MEMO, INPUT, OUTPUT, ELEMENT
SOURCES:	Given to all MEMOS and PROCESSES Use alphabetic prefix for specification, numeric paragraph number separated by periods, multiple sources allowed.
DESCRIPTIONS:	Contains information relating to LARE object document text or description of contents of data items.
TRACE KEYS:	Placed in higher level specification database to provide traceability to a lower level specification; same format as SOURCES.
ATTRIBUTES:	Three types used - frequency, file length, file type, LODE (Annex C ref) media, location and status
PART, SUBPART:	Places processes.
APPLIES, SEE MEMO:	Associates MEMO with PROCESS.
TRIGGERS, TRIGGERED BY:	Defines executive flow of PROCESSES.
UTILIZES, UTILIZED BY:	Defines use of other PROCESSES as subroutines.
CONSISTS OF, CONTAINED BY	Defines data structural relationships.
USES, USED BY:	PROCESS uses data if it operates on it but does not change it.
DERIVES, DERIVED BY:	Applies to data aggregates generated by a PROCESS.
UPDATES, UPDATED by:	Applies to data that is changed.

memo may be applied to more than one process. Memos are also used to call attention to special cases and are helpful as a way of communicating between analysts. For example, a memo tag attached to a series of output requirements stating "no-inputs found" remind the analyst that he/she has unresolved problems. If the problem is resolved the memo is disassociated from the output requirements that have been satisfied and left associated with unresolved problems.

B.1.4 SYNONYMS (SYN). All LARE PROCESS, and MEMO, INPUT, OUTPUT and ELEMENT names were given SYNONYMS.

SYNONYM generation must be consistent if it is to be effective. Once a SYNONYM has been assigned to a 30-character name that name can then be referenced by the shorter synonym string. This becomes helpful when loading massive updates to a database. It was also effective, in catching instances of inconsistent name assignment of INPUT and OUTPUT elements in both the MOM and MPOM.

SYNONYMS were derived by using the first two letters of an analyst assigned LARE name. For example, the SYNONYM for "generate-wo-status-age-listing" is "gewostagli." In the case of input and output elements, two synonyms were assigned. One was a Logicon-generated SYNONYM for the ELEMENT name. The other is the Army-assigned mnemonic for data elements. For example, the Logicon SYNONYM for the ELEMENT "identifying-number-code-old" is idnucool". The Army SYNONYM is "ident-no-cd-old".

B.1.5 SOURCE (SRC). A source identifies the specification and the paragraph number from which a requirement is taken. A SOURCE is associated with a PROCESS or MEMO in a database in order to provide traceability from the database back to the governing specification. Each AIRMICS source has an alphabetic prefix identifying the specification, for example, "m-" denotes the MOM specification. Then, the specification paragraph number follows. For example, MOM Specification paragraph number 3-7a(1)(a) is m-3.7.a.1.a as a LARE source. "P-" denotes a MPOM paragraph number.

Source references extracted from the various specification annexes were coded as follows:

m-a-i2.4Ø.ky fld.5

where

m = the specification itself
a = the Annex reference
remaining fields - represent references from either the input, output,
flowchart or decision tables

Thus m-a-i2.4Ø.ky.fld.5 indicates that the reference is from Annex A of the Maintenance Operations Management Specification, Float File Adjustment Input, I2.40.KY element found in field five (5).

Multiple sources are allowed for a single object name. These may occur because the same requirement is described from different points of view in two or more different sections. Multiple sources may also occur because a single requirement statement spans several subparagraphs.

B.1.6 DESCRIPTIONS (DESC). A description field is used to contain the text of the document paragraph from which the requirement was extracted. A description may be attached as a comment to a PROCESS, MEMO, INPUT, OUTPUT or ELEMENT. A description contains a maximum of 60 lines of text, with at most 72 character per line.

Descriptions associated with data items contain input events, output events, input and output controls; (if required) and in some cases, user preparation procedures.

B.1.7 Attributes (attr). Attributes were used to specify properties of a given section. Attributes assigned to input/output elements are: field length, field type and the Lode (the corresponding Annex C reference). Attributes assigned to OUTPUTS are frequency and media.

B.1.8 DATA AGGREGATES. Five LARE types of data aggregates were used to model the MPOM. They are SETS, INPUTS, OUTPUTS, ENTITIES and GROUPS.

Three LARE types of data aggregates were used to model the MOM. They are SETS, INPUTS and OUTPUTS.

B.1.8.1 SET. SETS can be defined as physical or logical views of the data as seen by the user, designer, and/or programmer.

B.1.8.2 INPUT (INP). An INPUT is used to describe a collection of information produced extenal to the target system. An INPUT shows the flow of data from the outside world into the system. Hence, it crosses the system boundary. The INPUT section is also used to uniquely identify each system input.

B.1.8.3 OUTPUT (OUT). An OUTPUT is used to describe a collection of information produced by the target system, then used external to that system. The OUTPUT section is used to show the flow of data from the sytem to the outside world. Hence, it crosses the system boundary. It can also be used to locate and uniquely identify each system OUTPUT.

B.1.8.4 ENTITIES (ENT). An entity is a logical, usable collection of data that serves a unique purpose within the system. An entity is information used by the target sytem that represents an object or concept internal to the system. It is required by the system for information processing purposes.

B.1.8.5 GROUP (GR). A GROUP is a logical collection of data elements and/or other GROUPS. A GROUP is a collection of information which can be contained in larger collections of information. INPUTS, OUTPUTS and ENTITIES. For example, a work order number could be defined as a GROUP containing supporting unit, intra-shop code, year and sequence. It was not; it was instead defined as an element. The ELEMENT (ELE) is the smallest item of data that can be referred to within the system and still maintain its unique properities.

B.1.9 LARE RELATIONSHIPS. As the LARE objects described above are the "nouns" in the syntax of the User Requirements Language, LARE relationships are the "verbs". The definitions of LARE relationships as they are used in the AIRMICS application appear in the following paragraphs.

B.1.9.1 PART, SUBPART (PART, SUBP). These relationships define the position of a PROCESS in the process hierarchy. For example, process-work-orders has the subparts enter-initial-wo-data, reconcile-wo-parts, enter-wo-status, close-out-wo, process-lookup-table-data, work-order-transfer, generate-work-order-data, edit-transactions, enter-parameter-data, update-internal-wo-files. Conversely, it can be said that the subparts are part of process-work-orders. These relationships apply to PROCESSES only. Each PROCESS may be part of only one higher-level PROCESS, but it may have multiple SUBPARTS.

B.1.9.2 APPLIES, SEE-MEMO (APPL, SM). These relationships define the connections between MEMOS and PROCESSES. MEMOS are said to apply to PROCESSES, conversely, PROCESSES are related to MEMOS via the SEE-MEMO relationship.

B.1.9.3 TRIGGERS, TRIGGERED by (TRGS, TRGS). These relationships define the flowchart structure in the execution of PROCESS. If one PROCESS TRIGGERS another, this means that the second PROCESS is exectued after the first; conversely one may write that the second PROCESS is TRIGGERED by the first.

B.1.9.4 UTILIZES, UTILIZED by (UTIS, UTLD). A PROCESS that can be looked upon as a "subroutine" of another PROCESS and in this sense subordinate to that PROCESS, handled in one of the following two ways. If the "subroutine" PROCESS is called upon only once, then this PROCESS is TRIGGERED first and it in turn TRIGGERS the major PROCESS. If there are several of these "subroutine" PROCESSES, they are TRIGGERED in turn. However, when the "subroutine" PROCESS is called upon more than once, then the main PROCESS UTILIZES the "subroutine" PROCESS although it may TRIGGER other PROCESSES itself.

B.1.9.5 INTERFACE (INTF). The INTERFACE is an object, organization or system outside the boundaries of the target system that interacts with the system being described. It identifies the origin and destination of system products.

B.1.10 Data Relationships The relationships described in the following paragraph are used for data aggregates.

B.1.10.1 CONSISTS of, CONTAINED in (CSTS, CNTD). These relationships define how data items are organized in a structural hierarchy. ENTITIES may consist of GROUPS. GROUPS may consist of other GROUPS or ELEMENTS. ELEMENTS may not consist of anything else. Conversely, GROUPS may be contained in ENTITIES. Other GROUPS or ELEMENTS may be contained in GROUPS. INPUTS and OUTPUTS may contain GROUPS and/or ELEMENTS and be contained within SETS. Nothing else may be contained in ELEMENTS.

B.1.11 PROCESS/DATA RELATIONSHIPS. The following relationships define actions which processes perform on data aggregates.

B.1.11.2 DERIVES, DERIVED BY (DRVS, DRVD). A PROCESS derives a data aggregate (conversely the data aggregate is derived by the PROCESS) when it completes operation on data it has obtained and puts out a changed data aggregate. If the data internal organization is changed by a PROCESS, a new data aggregate (with a different name) is considered to be derived by the PROCESS. In this case one data aggregate is used by the PROCESS and another derived.

B.1.11.3 UPDATES, UPDATED BY (UPDS, UPDD). A PROCESS UPDATES a data aggregate when it changes, expands or deletes information in that data aggregate without changing its basic nature. The name of the data aggregate remains the same and no new data aggregates are created.

B.2 LARE REPORTS

This section gives introductory descriptions of the LARE reports which have been most commonly used by analysts for this AIRMICS applications. These reports are:

Formatted Problem Statement (FPS)
Structure Report (STR)
Contents Report (CONT)
Name Generation (NG)
Name List (NL)
Process Chain (PC)
Data Process (DP)

In addition to the report descriptions, the formats of input files and modification files needed to build and maintain the databases are discussed.

It is worthwile to emphasize the fact that since the content of any report is simply a reflection of the information which has been prepared by the analyst, considerable attention should be paid to preparation of input files. Subsequently, fewer errors will be encountered during input and reports will contain correct and useful information.

B.2.1 FORMATTED PROBLEM STATEMENT (FPS). This report makes available all names and relationships associated with a name (or with a list of names in a file) specified in the command line which generates the report. The format

of the command is:

fps n = process-work-orders   where n = individual data base name

or

fps f = wo.inp   where f = file name containing a collection of names

where wo.inp is the name of the file segment containing a list of database names for which formatted problem statements are to be generated.

Figures B-1 and B-2 provide examples of FPS. Figure B-1 was produced by entering the command:

fps n = process-work-orders

Figure B-2 was produced by entering the command:

fps f = wo.inp

where the file name wo.inp contained the names of the five ELEMENTS shown.

Figure B-3 shows an FPS and the input file that generated the listing.

B.2.2 STRUCTURE REPORT (STR). This report gives an hierarchical structure of the PROCESS names in the specified database. The user has the option of including in the report MEMOS, SOURCES and/or relationships by which other names are associated with the PROCESS names present in the structure. Frequently, the analyst is interested in only a subset of the information in the database; the capability to produce a structure report on such subsets exists. The LARE command is:

str

At this point, the program requests the user to enter NAME, DEPTH, and OPTIONS. The NAME parameter can be any process name in the database whose SUBPARTS, to a specified DEPTH, will be reported in structure format. The DEPTH parameter, therefore, requires an integer representing the number of levels of SUBPARTS desired. Entry of a zero (Ø) for the NAME parameter implies that a full structure (i.e., all process names included) is required and entry of a zero for DEPTH will give all levels of SUBPARTS. Values for the OPTIONS parameter

```
                    LOGICON LEXINGTON VAX SYSTEM

                    formatted problem statement

parameters for: fps

  name=process-work-orders noindex print empty nopunch smarg=5 nmarg=20 amarg=10 bmarg=25
  rrmarg=70 cmarg=1 nmarg=40 nodesignate one-per-line define comment nonew-page nonew-line
  noall-statements complementary-statements line-numbers printeof

process                                 process-work-orders;
    synonyms are:  prwoor;
    subparts are:  enter-initial-wo-data,
                   reconcile-wo-parts,
                   enter-wo-update-data,
                   retrieve-wo-data,
                   report-wo-status,
                   close-out-wo,
                   process-lookup-table-data,
                   work-order-transfer,
                   generate-work-order-data,
                   edit-transactions,
                   enter-parameter-data,
                   update-internal-wo-files;
    part of:       sams-retail-wo-system;

eof eof eof eof eof
```

Figure B-1. Sample Formatted Problem Statement

```
                    LOGICON LEXINGTON VAX SYSTEM

                     formatted problem statement

parameters for: fps

   file noindex print empty nopunch smarg=5 nmarg=20 amarg=10 bmarg=25 rnmarg=70 cmarg=1 hmarg=40
   nodesignate one-per-line define comment nonew-page nonew-line noall-statements
   complementary-statements line-numbers printeof

   element                                  estimated-delivery-date;
       synonyms are:   edd,
                       esdeda;
       attributes are:
            field-length   L3,
            field-type     numeric,
            loc-den        m-0037-05;
       contained in:   supply-recon-data-record-an-x;
       source is:      m-a.12.18.an.fld.17;

   element                                  estimated-delivery-date-order;
       synonyms are:   esd-ord,
                       esdedaor;
       description;
   sig: n/a;
       attributes are:
            field-length   52,
            field-type     numeric,
            loc-den        m-0044-91;
       contained in:   inop-equipment-parts-out,
                       part3-supply-status-report,
                       inop-equip-sta-data-request-rep;
       used by:        xm-rap-dectbl-input-datacheck;
       source is:      m-b.01.02.43.fld.14,
                       m-b.02.35.40.fld.52,
                       m-b.02.63.64.fld.24;

   element                                  estimated-repair-parts-cost;
       synonyms are:   esrepaco,
                       est-rep-part-cost;
       attributes are:
            field-length   L9,
            field-type     numeric,
            loc-den        m-0027-07;
       contained in:   parts-status-data-record,

                       xm-rr-dectbl-input,
                       xm-rap-dectbl-input;
       used by:        xm-rap-dectbl-input-datacheck;
       source is:      m-a.12.13.kz.fld.11;
```

Figure B-2. Sample Formatted Problem Statement Output

LOGICON LEXINGTON VAX SYSTEM

formatted problem statement

parameters for: frs

```
file noindex print empty nopunch smarg=5 nmarg=20 amarg=10 bmarg=25 rnmarg=70 cmarg=1 hmarg=40
nodesignate one-per-line define comment none*-page none*-line noall-statements
complementary-statements line-numbers printeof

 1 process                                 enter-reconciliatn-parts-data;
 2     description;
 3 For the MRM: Reconciliation Parts Data shall be entered in real time
 4 using a DIC of XRR.;
 5
 6 process                                 enter-wo-parts-supplemntal-paa;
 7     description;
 8 For the MRM: The Shop Office Clerk shall enter supplemental WO
 9 parts data when the Repair Parts form requires supplemental parts that
10 are on hand.  Copy 3 of the work order Supplemental Parts Request
11 shall be used for entry;
12
13 process                                 gen-error-listing;
14     synonyms are:  qeerl1;
15     description;
16 For the MRM: After AB1/DRU Requirements record is processed
17 Error Listing shall be generated (if error message present).;
18     source is:     m-5.13.c;
19
20 process                                 gen-reconciliation-exception;
21     description;
22 For the MRM: Mismatches between Reconciliation Subprocess and
23 the [illegible] File shall be printed on the Reconciliation Exception
24 Report.;
25
26 process                                 generate-manual-requisition;
27     description;
28 For the MRM: Manual Requisition shall be generated for parts needing
29 lead time.;
30
31 process                                 inspect-nors-norm-data;
32     description;
33 For the MRM: The Nors Norm data shall be [illegible] consistent to MRR
34 Reports, enabling the [illegible] current [illegible].;
35
```

TOP PORTION OF INPUT FILE WAS USED TO GENERATE LINES 1 THRU 35 OF THE FORMATTED PROBLEM STATEMENT

INPUT FILE

100	enter-reconciliatn-parts-data
200	enter-wo-parts-supplemntal-paa
300	gen-error-listing
400	gen-reconciliation-exception
500	generate-manual-requisition
600	inspect-nors-norm-data
700	print-error-exceptn-rpt
800	proc-wo-rqmts-sup-prts-ed-sut
900	process-wo-consumption-parts
1000	request-work-order-registratia
1100	submit-dic-aml
1200	xm-dt-dectbl-input-datachek

Figure B-3. Example Formatted Problem Statement and Input File

are one or more of the following:

r (include source references)
m (include memos)
a (include all associated names)
p (none of the above, include process names only).

Two examples of valid responses to the program's prompt are:

```
00 r  m
```

or

```
your-process  4  ra
```

See Figures B-4, B-5, B-6. Figure B-4 shows the structure of all levels under enter-initial-owo-data printed with the "p" option. Notice that one of its subparts is enter-standard-wo-data which has eight subparts itself. Figure B-5 is a structure generated with this name and the "a" option. It therefore includes all names related to each of the eight subparts.

Figure B-4 was produced by:

```
str
enter-initial-wo-data    0   p
```

Figure B-5 was produced by:

```
str
enter-standard-wo-data   0   a
```

Figure B-6 was produced by:

```
str
enter-initial-wo-data    0   r
```

Figure B-3 shows an FPS and the input file that generated the listing. And as shown, MOM paragraph references are included, as well as all SUBPARTS (or subprocesses) enter-initial-wo-data and enter-standard-wo-data.

```
CADSAI version  3.2K2                                   APR 29, 1981  09:48:31      page      1
                              LOGICON LEXINGTON VAX SYSTEM

                                      process structure

parameters for: str

   process indent=3 noindex

count level name

   1   3 enter-initial-wo-data
   2     4 enter-standard-wo-data
   3       5 assign-equip-recall-reqmnt-won
   4       5 assign-intra-shop-wo-numbers
   5       5 ent-assigned-work-order-number
   6       5 enter-work-order-task-data
   7       5 enter-wo-evacuation-data
   8       5 process-maintenance-request
   9       5 register-intra-shop-work-order
  10       5 enter-work-order-parts-data
  11         6 enter-wo-supplmntal-parts-data
  12         6 enter-wo-parts-reassignments
  13           7 re-assign-wo-parts
  14         6 xt-cp-dectbl-input-datacheck
  15         6 xt-cs-dectbl-input-datacheck
  16         6 process-edit-subprocess
  17       5 enter-registration-wo-data
  18         6 xt-a-dectbl-input-datacheck
  19         6 xt-c-dectbl-input-datacheck
  20         6 process-wo-registration-data
  21       5 enter-wo-requirements-data
  22         6 process-wo-requirements-tasks
  23     4 enter-production-wo-data
  24       5 ent-prod-program-mgmt-detrmn
  25       5 establish-maint-production-prg
  26       5 xt-d-dectbl-input-datacheck
  27       5 process-maint-prog-dat-inp-sub
  28     4 enter-dit-sro-data
```

Figure B-4. Sample Process Structure with the "p" Option

```
CADSAT version  3.2H2                                    APR 21, 1981  20:40:32      page      7
                                   LOGICON LEXINGTON VAX SYSTEM

                                         process structure

 parameters for: str

   process indent=3 noindex

 count (level or relationship)  names

    1   4 enter-standard-wo-data
    2      5 assign-equip-recall-reprnt-won
    3      5 assign-intra-shop-wo-numbers
    4      5 ent-assigned-work-order-number
             uses work-order-number
    5      5 enter-work-order-task-data
    6      5 enter-wo-evacuation-data
    7      5 process-maintenance-request
             trns determine-required-calibration
             trns determine-required-maint-service
    8      5 register-intra-shop-work-order
    9      5 enter-work-order-parts-data
   10        6 enter-wo-supplmntal-parts-data
   11        6 enter-wo-parts-reassignments
   12          7 re-assign-wo-parts
   13        6 xm-cp-dectol-input-datacheck
                uses file-input-action-code
                uses task-sequence-field
                uses identifying-number-code
                uses part-number-field
                uses item-noun
                uses failure-code
                uses routing-identifier-code
                uses signal-code
                uses advice-code
                uses unit-of-issue
                uses demand-code
                uses repair-parts-nors-designator
                uses part-source-code
                uses cond-designator-requis-action
                uses transaction-quantity-issued
                uses document-control-number
   14        6 xm-cs-dectol-input-datacheck
                uses file-input-action-code
                uses task-sequence-field
                uses item-noun
                uses identifying-number-code
                uses part-number-field
                uses transaction-quantity-issued
                uses document-control-number
                uses repair-parts-nors-designator
   15        6 process-edit-subprocess
                uses xm-cp-dectnl-input
   16      5 enter-registration-wo-data
   17        6 xm-a-dectnl-input-datacheck
                uses documentation-identifier-code
                uses file-input-action-code
                uses unit-id-code-support-unit
                uses unit-id-code-customer-unit
                uses intra-shop-code
                uses end-item-component-indic-field
                uses identifying-number-code
                uses part-number-field
                uses cond-desig-reimbursable-cust
                uses materiel-readi-reporting-desig
                uses item-nomen-item-noun
                uses sequence-number
   18        6 xm-b-dectnl-input-datacheck
                uses file-input-action-code
                uses supplemental-data-code
                uses supplemental-data-field
                uses quantity-to-be-repaired
                uses type-maint-request-or-rep-code
                uses miles-usg-at-submis-of-wrk-req
                uses rounds-usg-at-subms-of-wrk-req
                uses autortn-usg-at-sbms-of-wrk-req
                uses maintenance-repair-code
                uses maintenance-level-unit-code
                uses recall-interval-code
                uses condition-designator-warranty
                uses failure-detected-during-code
                uses condition-code
                uses equipment-utilization-code
                uses weapon-system-designator-code
```

Figure B-5. Sample Process Structure with the "a" Option

```
CADSAT Version  3.2R2                              APR 28, 1981  09:17:24       page      1
                                  LOGICON LEXINGTON VAX SYSTEM

                                        process structure

parameters for: str

   process indent=3 noindex

count level name                                 reference

    1  4 enter-standard-wo-data
    2     5 assign-equip-recall-reprint-won        m-4.14.b
    3     5 assign-intra-shop-wo-numbers           m-4.10.x.2
    4     5 ent-assigned-work-order-number         m-4.15.c
                                                   m-4.17.a
    5     5 enter-work-order-task-data             m-4.10.o
                                                   m-4.10.x.5
                                                   m-4.10.q
    6     5 enter-wo-evacuation-data               m-4.10.r
    7     5 process-maintenance-request            m-4.14.e
    8     5 register-intra-shop-work-order         m-4.10.x.2
    9     5 enter-work-order-parts-data            m-4.12.n
   10        6 enter-wo-supplmntal-parts-data         m-4.12.n
                                                      m-4.12.k
   11        6 enter-wo-parts-reassignments           m-4.10.ss
   12           7 re-assign-wo-parts                     m-5.8.o
   13        6 xm-cp-sectol-input-datacheck
   14        6 xm-cs-sectol-input-datacheck
   15        6 process-edit-subprocess                m-n-table-no231
   16     5 enter-registration-wo-data             m-5.8.a
   17        6 xm-w-dectnl-input-datacheck
   18        6 xm-p-dectnl-input-datacheck
   19        6 process-wo-registration-data
   20     5 enter-wo-requirements-data             m-5.8.b
                                                   m-5.10.p
   21        6 process-wo-requirements-tasks          m-r-table-no201



level count   level count   level count   level count   level count
    1    0        2    0        3    0        4    1        5   10
    6    9        7    1
```

Figure B-6. Sample Process Structure with "r" Option Only

AD-A100 847 LOGICON INC LEXINGTON MA F/G 9/2
AIRMICS LARE/CADSAT ANALYSIS.(U)
APR 81 K M TERRELL, L A JOHNSON DAHC26-80-C-0021
UNCLASSIFIED R81003(A) NL

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and as shown, MOM paragraph references are included, as well as all subparts (or subprocesses) enter-initial-wo-data and enter-standard-wo-data.

B.2.3 Contents Report (CONT). The Contents Report gives a structure of data names (as contrasted with process names). The INPUTS to "contents" must be ENTITY or GROUP names because these are the objects which consist of other GROUPS or of ELEMENTS. An example of a Contents Report appears in Appendix D, Figure D-4.

```
cont n = mpom-internal-data
```

or

```
cont f = your-file
```

are examples of valid commands. The file your.file would usually contain several entity/group names.

B.2.4 Name-List (NL). Name List shows alphabetically every name in the database. An example NAME-LIST appears in Appendix D, Figure D-8.

B.2.5 Name-Generation (NG). Name Generation is a useful method of creating file(s) containing database names, to be used as inputs to other report generating programs. The user controls the types of names to be included by specifying values of a selection parameter. The selected names will be extracted from the database and put into a file which is usually used as input to other commands. The format of the command is:

```
ng s = "some boolean expression"
```

or

```
ng s = "some boolean expression" punch = your.file
```

Inclusion of the punch file parameter is optional. When it is omitted, a default file name is used.. The selection parameter is aesignated by the "s".

The general forms for the boolean expression are:

"operand operator operand"

or simply

"operand"

Operands are legal data base names types (process, keyword, etc.) and operators can be & (AND) and (OR). The following three examples of possible command lines should clairfy this description.

```
ng s = "process" punch = proc.inp
ng s = "entity group"
ng s = "process & keyword = m-5.8.c " punch = your.inp
```

The first command will put all PROCESS names into a user defined file named proc.inp. The second command wil extract all of the database names which have been defined as either GROUP or ENTITY and put the list into a default file in the users directory. This command also illustrates the method of using the output file from ng as input to another command. If the user were to enter:

```
cont
```

following execution of the second ng example, a Contents Report would be produced giving a structured list of the contents of each GROUP or ENTITY name in NG's output file.

Following execution of the third NG example, the names of only those processes with the associated keyword m-5.8.c will be extracted from the database and put into your.file.

```
ng s = some process-inp
```

or

```
pc f = some.inp
```

B.2.6 Data Process (DP). The output of Data Process depicts, in matrix format, the relationships between data and processes. A data item is an ENTITY, GROUP or ELEMENT, a relationship is USES, USED BY, DERIVES, DERIVED BY, etc. The report also includes a brief analysis of each matrix and states any inconsistencies in the data flow.

When generating this report, the user has the option of specifying either data items or PROCESSES as INPUT. The report may be produced for a single name is necessary.

To generate the report, enter one of the following commands. Note, however, that when the input file is not specified in the command line, the Data Process will assume the existence of Names-Gens's default file in the user's directory.

```
dp  d
dp  d  n = name-of-data-type
dp  d  f = your.file
```

The 'd' in the above commands implies that data item names are being used as input so the program will then search the data base for the related PROCESSES to generate the matrices.

When the user enters on of the following commands

```
dp p
dp  n = process-name
dp  p = your.file
```

The program expects to receive process names from the input and will then find An example Data Process report appears in Appendix D, Figure D-5.

B.2.7 Input Files (IP). The content of input files will vary depending upon whether the analyst is in the early stages or later stages of data base development. Typical early stage input consists of:

PROCESS names
SOURCES
MEMOS
DESCRIPTION statements.

An example will best illustrate the required format of input files.

Assume that several requirements are known, some of which are sub-requirements of others. Name them process-1a, process-1b, process-2a, process 2-b, etc. Now let their respective B5 paragraph references be k-1a, k-1b, k-2a, etc. It may also be necessary to input text which describes someof the requirements, such as MEMOS. All of this information must then be entered into the database base in a structured manner. Examine the following input (IP) file. This general format is required for correct data entry.

Later stage input involves using all of the CADSAT name types and relationships which are valid for AIRMICS application. Analysts set up relationships (such as TRIGGERS) between PROCESSES allowing data flows and process chains to be defined.

B.2.8 Modification Files. There are four types of database modification files:

```
DPSL  (Delete Problem Statement Language)
DEL   (Delete)
REN   (Rename)
CT    (Change Type)
```

B.2.9. DPSL Files. The format of DPSL files is identical to that of ip files but are used to "disconnect" relationships between names. Consider the following dpsl file:

```
prc   process-1a,
key   k-1a,
subp  process-x,
eof,
```

After DPSL processes the above input, the keyword k-1a is no longer associated with process-1a and process-x is no longer a SUBPART of process-1a. However, all three names still exist in the database. The form of the command is

```
dpsl  f = your.inp
```

B.2.10 DEL Files. The format of the Delete command is one of the following:

```
del   n = some name
el    f = some.file
```

This command is used to actually delete names form the database entirely (and therefore the relationships to other names). The form of the input file is simply a list of data basenames to be deleted:

```
some-process-1a
some-keyword
some-process-b
some-data name
```

B.2.11 Rename Files. The format of the Rename command is one of the following:

```
ren  p = old name     n = new name
ren  f = some.file
```

This command is used to rename objects in the database (you may also want to change their synonyms). The input file format is:

```
old-name-a     new-name-a
old-name-b     new-name-b
.
.
.
```

B.2.12 Change Type Files. The change type command is either

```
ct  n = some.name     t = new type
```

or

```
ct  f = some.file     t = new type
```

Change Type is used to correct the "type" of database objects. For example, if a number of objects were mistakenly entered as GROUP names and should have been ELEMENTS the following command should be entered:

```
ct  f = some.file     t = element
```

where some.file contains:

```
element-a
element-b
element-c
.
.
.
```

APPENDIX C
PROPOSED LARE ENCHANCEMENTS

C. INTRODUCTION

This study and other previous applications have found LARE an effective methodology/tool for analyzing and defining system requirements. Even though Logicon has been successful, with a number of LARE enhancements could make the technology even more effective and easier to use. Proposed enhancements have been grouped into three categories: specification generation, data representation/display, and information reporting.

C.1 Specification Generation

One of the chief advantages of LARE is the ability to generate text specifications directly from the computerized databases. Enhancing the capability to provide the following is desirable:

C.1.1 Generate Automatically Maintained Table of Contents

The ability exists to generate text paragraph numbers automatically based on functional hierarchical structure or generate the text in an arbitrary order based on predefined paragraph numbers. The missing capability is to generate the table of contents including the key text phrase and the appropriate page number.

C.1.2 Develop a Generalized Specifications Generation Language

Logicon has generated text for system specifications in several different formats. Changing the format requires software adaptation of the specification generator. What is desired is a simple specification generation language which would permit the user to define the specification format, and enable the use of specialized symbols embedded in the text to control printing format. The capability should include the option to indicate specific terms for inclusion in an index.

C.2 Data Representation/Display

The presentation of information could be improved to aid the analyst in understanding relationships among requirements the inconsistencies or incompleteness of the requirements. The following presentation improvements have been identified:

C.2.1 Upgrade Process-Chain Report to Provide Relational Control Flow

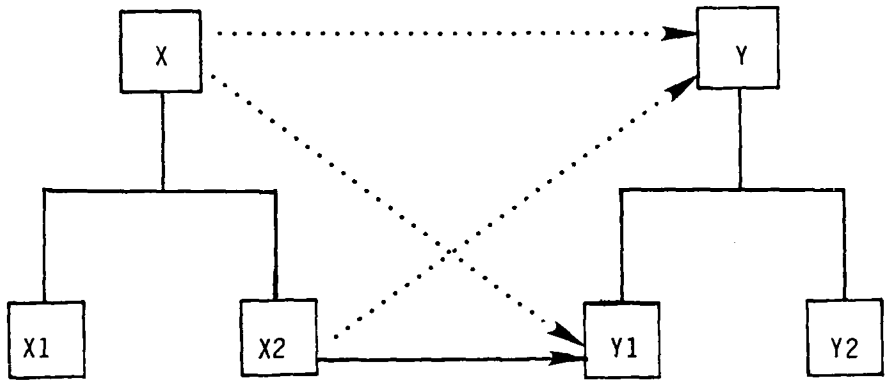
The Process-Chain Report should include an option to allow display of control flow relations, whether explicit or implicit, at any level of a functional hierarchy. This capability will allow the analyst to identify loops and logic errors. With the example in Figure C-1, the user could specify "Level =1" and have the Process-Chain depict control flow at the highest level of the functional hierarchy (X TRIGGERS Y, in the example) even though the relationship is implicit. This would allow the analyst to look at any level of the functional hierarchy without losing information.

C.2.2 Improve Reports to Provide Relational Data Flow

This modification would impact the Data Process, Extended Picture, and Process Input/Output Reports. The most natural technique for implementing this modification would infer existence of data flow relationships, which are specified at any level of functional hierarchy, into all higher-level functions. Thus, with the example in Figure C-2, the USES/DERIVES relationship would be inferred by LARE to apply to functions X and Y. (in addition to their subparts). This modification improves the visibility of data flow relationships.

C.2.3 Augment Reports to Provide Relational Data Structure

This modification would affect the Data Process, Extended Picture, and Process Input/Output Reports. Whenever a data name is specified with a data flow relationship, all lower levels of the data name's hierarchy should be included in the relationship.



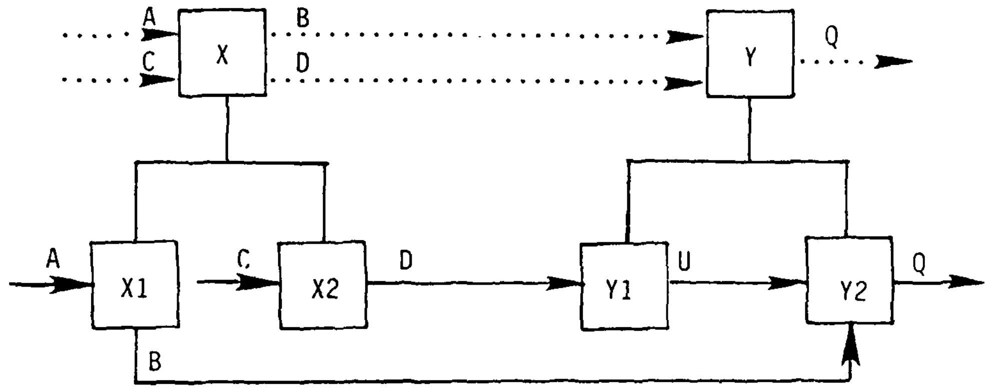
PROCESS X;
SUBPARTS X1, X2;

PROCESS Y;
SUBPARTS Y1, Y2;

PROCESS X2;
TRIGGERS Y1;

__________ = control flow depicted by Process-Chain
.... = control flow not depicted by any report

Figure C-1. Example of Control Flow Anomaly



PROCESS X
SUBPARTS X1, X2;

PROCESS X1,
USES A;
DERIVES B;

PROCESS X2;
USES C;
DERIVES D;

PROCESS Y
SUBPARTS Y1, Y2;

PROCESS Y2
USES B, U;
DERIVES Q;

PROCESS Y1;
USES D;
DERIVES U;

__________ = explicit data flow
.... = implicit data flow

Figure C-2. Example of Data Flow Anomaly

C.2.4 Add Condensed Listing

A condensed listing option would allow the user to format pictorial reports in listing form. This, modification in conjunction with a pictorial report, could guide the analyst in identifying links across page boundaries or it could be used independently. Unlike long pictorial reports, the condensed listing report is easy to follow. Figure C-3 shows one possible format. Its corresponding system diagram is shown in Figure C-4.

C.3 Information Reporting

There are several circumstances in which the handling of relevant information is awkward and the information not readily available. The following recommended enhancements are of this type:

C.3.1 Enhanced to NAME-GEN to Provide Source References

NAME-GEN should be extended to generate a list of all reference numbers contained in the database within a given interval (i.e., 3.2.1 - 3.2.7). This would simplify completeness checking during specification analysis and generation. In general, it would be helpful if users could supply alphabetic or numeric ranges of objects to be selected by NAME-GEN for use by additional report generations.

C.3.2 Expand Contents Reprots to Provide Source References for Data Types

The LARE Contents Report should be extended to allow data structure reports similar to the Logicon Extended Structure Report. The Contents Report should present SOURCE references for each data type, in addition to the relationships appropriate for data (DERIVED BY, UPDATED BY, etc.). This extension would consolidate information now contained in separate LARE reports.

C.3.3 Expand Triggers Relation to Allow Boolean Conditions

LARE should be augmented to handle conditional control flow and Boolean conditions. This feature would increase LARE's ability to accurately record specification information.

```
Line No*  Count+                                                                         References +
   1         5   Function-A                                                              s-3.7.2
   2        15      Function-B   UTIL      Function-C                                    s-3.7.2.1
   3         7         Function-D                                                        s-3.7.2.1
   4         9            Function-E                                                     s-3.7.2.2
   5         2            Function-F                                                     s-3.7.2.2
   6        10               Function-G   TRGD WHEN   E&F complete      TRUE             s-3.7.2.1
   7        14                  Function-H   WHEN     condition-name    TRUE             s-3.7.2.2
   8        15                  Function-I   WHEN     condition-name    FALSE            s-3.7.2.2
   9        12                     Function-J                                            s-3.7.2.3
```

Notes:

* - This is a sequential number for easy reference to a specific line in the report.

\+ - These correspond to the hierarchical level of number of the INTF, PROC, and I/O types in their respective structure reports.

\+ - These are source document paragraph numbers for the adjaent INTF, PROC, or I/O types.

Figure C-3. Example Control Flow Report Using the Indented Format

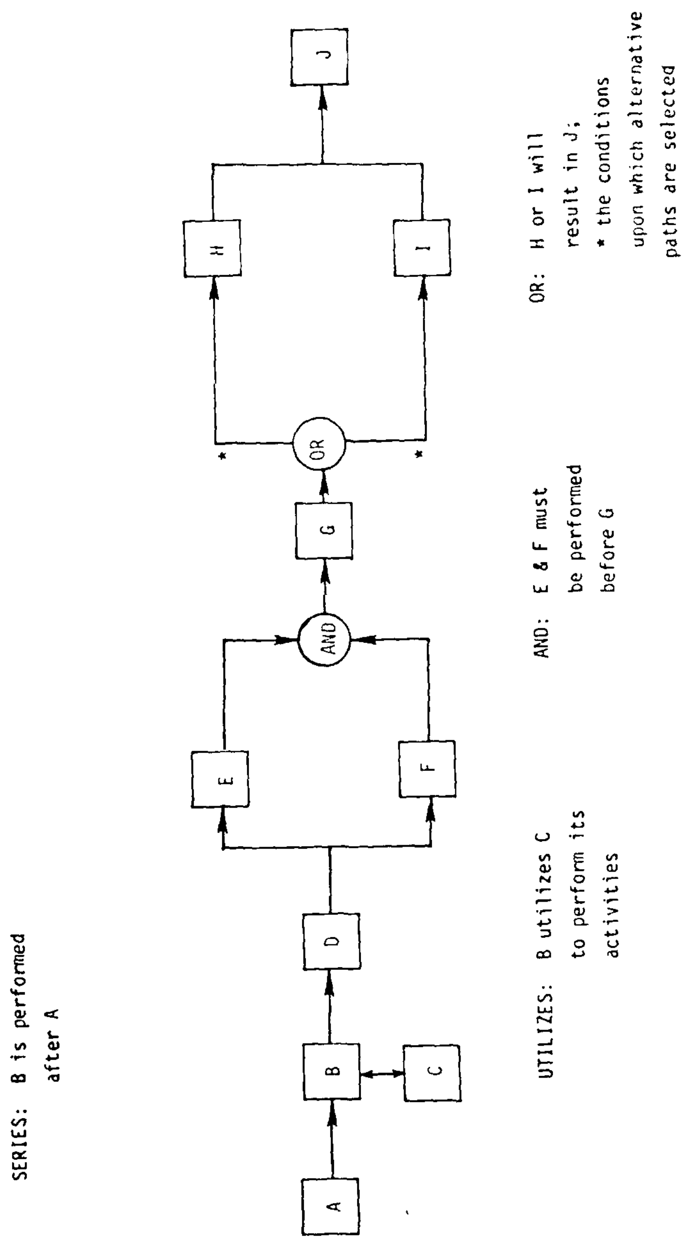


Figure C-4. Control Flow Diagram

This feature increases CADSAT's ability to accurately record specification information.

C.3.4 Add Source-relationship Tags

Neither relationships (USES, DERIVES, etc.) nor conditions can have SOURCES attached to them. Develop an ATTACH statement which attaches a SOURCE name to anything in the database. No strong need for this modification has been uncovered by this study, but the feature would have been used if it had been available.

C.3.5 DBSTATUS Short Form

The DBSTATUS report needs a short form which includes only the sources, names and index value. This report could produce the "table of contents" for the structure report at less expense than the current, full DBSTATUS report.

APPENDIX D

Sample LARE Outputs

D. INTRODUCTION

Eight of the typical LARE reports used in the performance of the AIRMICS study have been included:

- STRUCTURE - structure report showing the functional hierarchy of the MOM and MPOM. (Figures D-1 and D-2)
- CONSISTS MATRIX - matrix and listing detailing those elements contained in specific inputs in the MPOM. (Figure D-3)
- CONTENTS - report showing data structure relations in the MPOM. (Figure D-4)
- DATA PROCESS - this report depicts in matrix format, the relationship between data and processes. (Figure D-5)
- DATABASE STATUS - report showing the status of each requirement and the types of relations defined. (Figure D-6)
- FORMATTED PROBLEM STATEMENT - report depicting all of the information in the database for the specified items. (Figure D-7)

- NAME LIST - report showing all names in the database. (Figure D-8)

```
CADSAT version  3.2R2                                      APR 28, 1981  15:47:21      page      1
                              LOGICON LEXINGTON VAX SYSTEM
                                    process structure

parameters for: str

  process indent=3 noindex

count level name                             reference

   1  1 sams-retail-mom-system
   2     2 produce-support-plan
   3        3 maint-support-plan
   4           4 process-cross-ref-upd-sub          m-n-table-no1150
   5     2 process-work-orders
   6        3 enter-initial-wo-data
   7           4 enter-standard-wo-data
   8              5 assign-equip-recall-reqmnt-won     m-4.14.b
   9              5 assign-intra-shop-wo-numbers       m-4.10.x.2
  10              5 ent-assigned-work-order-number     m-4.15.b
                                                       m-4.17.a
  11              5 enter-work-order-task-data         m-4.10.q
                                                       m-4.10.x.5
                                                       m-4.10.q
  12              5 enter-wo-evacuation-data           m-4.10.r
  13              5 process-maintenance-request        m-4.14.e
  14              5 register-intra-shop-work-order     m-4.10.x.2
  15              5 enter-work-order-parts-data        m-4.12.d
  16                 6 enter-wo-supplmntal-parts-data     m-4.12.h
                                                          m-4.12.k
  17                 6 enter-wo-parts-reassignments       m-4.10.ss
  18                    7 re-assign-wo-parts                 m-5.8.o
  19                 6 xm-cp-dectbl-input-datacheck
  20                 6 xm-cs-dectbl-input-datacheck
  21                 6 process-edit-subprocess            m-n-table-no231
  22              5 enter-registration-wo-data         m-5.8.a
  23                 6 xm-a-dectbl-input-datacheck
  24                 6 xm-p-dectbl-input-datacheck
  25                 6 process-wo-registration-data
  26              5 enter-wo-requirements-data         m-5.8.b
                                                       m-5.10.b
  27                 6 process-wo-requirements-tasks      m-n-table-no201
  28           4 enter-production-wo-data
  29              5 ent-prod-program-mgmt-detrmn       m-4.17.j
```

Figure D-1. LARE Process Structure of the MOM

process structure

```
count level name                              reference
   30          5 establish-maint-production-prg   m-5.8.f
   31          5 xm-o-dectbl-input-datacheck
   32          5 process-maint-prog-dat-inp-sub   m-h-table-no551
   33        4 enter-alt-sro-data
   34      3 reconcile-wo-parts
   35        4 forward-wo-rep-prts-frm          m-4.10.y.2
   36        4 transfer-data-to-rpf             m-4.12.c
   37        4 enter-reconcilation-parts-data   m-5.8.k
                                                m-5.10.c.3
   38        4 gen-cust-wo-reconciliation-p1    m-5.9.k
   39        4 gen-cust-wo-reconciliation-p2    m-5.9.k
   40        4 gen-reconciliation-exceptiont    m-5.10.f
   41        4 gen-reconciliation-response      m-5.10.f
   42      3 enter-wo-update-data
   43        4 annotate-wo
   44          5 annotate-work-order              m-4.12.g
                                                  m-4.13.g
                                                  m-4.10.11
                                                  m-4.10.o.1
                                                  m-4.10.o.3
                                                  m-4.10.ff
   45        4 key-wo-change-data
   46          5 process-wo-parts-adj-sub         m-h-table-no1101
                                                  m-h-table-no1
   47        4 enter-wo-completion-data         m-4.10.q
                                                m-4.10.q
   48          5 xm-d-dectbl-input-datacheck
   49          5 xm-dp-dectbl-input-datacheck
   50          5 process-wo-consumption           m-h-table-no300
   51          5 process-wo-consump-parts
   52        4 enter-work-order-status-update   m-4.10.w.3
                                                m-4.10.mm
                                                m-4.10.pp
                                                m-4.10.aa
   53          5 xm-s-dectbl-input-datacheck
   54          5 process-wo-status-data-subp      m-h-table-no1001
   55        4 enter-work-order-time-expended   m-4.10.q
                                                m-4.10.x.5
   56          5 xm-dl-dectbl-input-datacheck
   57          5 process-wo-consumption-manhrs    m-h-table-no371
```

Figure D-1. LARE Process Structure of the MOM (Cont'd.)

```
                              process structure

count level name                            reference
  58         4 enter-class-inspectn-form-data   m-4.10.o.5
  59         4 inspection-wo-status-change
  60         4 reenter-work-order-copies
  61         4 transfer-wo-data-computr-media   m-4.10.z
                                                m-4.10.qq
  62         4 work-order-update
  63           5 real-time-process-work-orders    m-4.14.1
  64         4 change-maint-prod-prgm-data      m-5.6.f
  65         4 change-work-request-status       m-5.8.1
  66         4 enter-task-completion-data       m-5.6.c
  67           5 xm-ct-dectbl-input-datacheck
  68           5 xm-dt-dectbl-input-datacheck
  69           5 xm-t-dectbl-input-datacheck
  70           5 process-task-compl-edit-supp     m-h-table-no301
  71         4 enter-labor-usage-data           m-5.6.c.1
  72         4 xm-w-dectbl-input-datacheck
  73         4 xm-x-dectbl-input-datacheck
  74       3 retrieve-wo-data                 m-5.8.g
  75         4 retrieve-annotated-work-orders   m-4.13.e
  76         4 retrieve-work-order-jacket       m-4.20.n
  77         4 request-wo-registration-data     m-4.10.x.3
  78         4 retrieve-tpr-data                m-5.8.g
  79         4 xm-h-dectbl-input-datacheck
  80         4 process-inquiry                  m-h-table-no601
  81       3 report-wo-status
  82         4 print-standard-wo-reports
  83           5 gen-monthly-work-order-report    m-4.11.hh
  84           5 print-error-exceptn-rpt-wo       m-4.11.1
                                                  m-4.12.r.1
                                                  m-4.12.u
  85           5 print-open-status-work-orders    m-4.11.h
  86             6 find-open-work-orders            m-4.11.h
  87           5 prepare-work-order-info          m-4.10.d
  88             6 generate-wo-summary              m-5.9.a
  89           5 generate-wo-register-status-rp   m-5.9.d
  90           5 generate-wo-status-age-listing   m-5.9.1
  91           5 generate-workload-summary        m-5.9.c
  92         4 print-production-reports
  93           5 gen-maint-program-control-doc    m-5.15.a
  94           5 gen-maint-program-status-rep     m-5.15.b
```


Figure D-1. LARE Process Structure of the MOM (Cont'd.)

```
                              process structure

count level name                               reference
  95          4 print-alt-sro-reports
  96             5 gen-alt-sro-application-report   m-5.13.d
  97             5 gen-alt-sro-schedule             m-5.13.c
  98          4 notify-customer                  m-4.10.t
                                                 m-4.10.u
                                                 m-4.10.v
  99          4 generate-transfer-file           m-5.9.i
 100          4 gen-doc-register-open-supply     m-5.9.n
 101          4 transfer-data-to-mpom            m-5.9.r
 102       3 close-out-wo
 103          4 print-wo-regstr-closed           m-4.11.o
 104          4 work-order-closeout              m-4.10.mm
 105          4 gen-wo-register-closed-listing   m-5.9.j
 106             5 gen-doc-register-closed-supply   m-5.9.o
 107       3 process-lookup-table-data
 108          4 insert-lookup-table-data         m-4.10.tt.2
 109          4 delete-lookup-table-data         m-4.10.tt.2
 110          4 enter-lookup-table-data          m-5.8.d
 111          4 xm-y-dectbl-input-datacheck
 112       3 work-order-transfer
 113          4 send-wo-with-equipment           m-4.20.b
 114       3 generate-work-order-data
 115          4 generate-wo-number               m-5.8.a
 116       3 edit-transactions               m-5.8.p
 117       3 enter-parameter-data            m-5.8.r
 118          4 xm-za-dectbl-input-datacheck
 119          4 xm-zb-dectbl-input-datacheck
 120          4 xm-zc-dectbl-input-datacheck
 121          4 xm-zd-dectbl-input-datacheck
 122          4 xm-ze-dectbl-input-datacheck
 123          4 xm-zf-dectbl-input-datacheck
 124          4 xm-zg-dectbl-input-datacheck
 125          4 xm-zh-dectbl-input-datacheck
 126          4 process-param-duty-hours         m-n-table-no1295
 127          4 process-param-nors-norm-data     m-n-table-no1280
 128          4 process-param-prev-cyc-dat       m-n-table-no1285
 129          4 process-param-repts-control      m-n-table-no1274
 130          4 process-param-wo-age             m-n-table-no1213
 131          4 process-param-workld-back-age    m-n-table-no1233
 132          4 process-parameter-subo           m-n-table-no1200
```

Figure D-1. LARE Process Structure of the MOM (Cont'd.)

```
                                   process structure

count level name                             reference
  133          4 process-parm-prts-sta-det        m-h-table-no1255
  134        3 update-internal-wo-files
  135          4 gen-error-exception-listing      m-5.9.n
                                                  m-5.9.m
  136          4 generate-contingency-files       m-5.9.q
  137          4 update-daps-file                 m-5.12.c
  138      2 process-task-performance-data
  139        3 sample-task-performance-data
  140        3 report-task-performance
  141        3 distribute-tpf-data              m-4.18.b
  142        3 enter-task-perf-factor-adj       m-5.8.m
  143        3 task-perf-fact-adj-supp
  144      2 maint-parts-inventory
  145        3 inter-mgt-annot-shop-sup-list    m-4.12.r.6
  146        3 annotate-repair-parts-form       m-4.12.f
                                                m-4.12.g
                                                m-4.12.h
                                                m-4.12.i
                                                m-4.12.n
  147        3 enter-shop-supply-data           m-4.12.r.7
  148          4 enter-part-number-change         m-4.10.rr
  149            5 xm-n-dectbl-input-datacheck
  150          4 enter-repair-parts-form-data     m-4.12.p
  151          4 generate-manual-requistion       m-4.17.c
  152          4 submit-dic-aml                   m-4.12.r.1
  153          4 enter-da-form-data               m-4.12.e
  154          4 enter-bslf-change-data           m-4.12.a
  155          4 post-cancel-reconcil-resp-meda   m-4.12.w.2
  156          4 change-bench-stock-list          m-5.8.j
                                                  m-5.10.a.1
                                                  m-5.10.d.2
                                                  m-5.10.e
  157            5 process-bench-st-adj-require
  158          4 change-part-number               m-5.8.i
  159          4 change-shop-stock-list           m-5.6.j
                                                  m-5.10.a
                                                  m-5.10.d.2
                                                  m-5.10.e
  160            5 xm-pa-dectbl-input-datacheck
  161            5 xm-pb-dectbl-input-datacheck
```

Figure D-1. LARE Process Structure of the MOM (Cont'd.)

```
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                                  LOGICON LEXINGTON VAX SYSTEM

                                        process structure

count level name                                 reference
  162                 5 xm-pd-dectbl-input-datacheck
  163                 5 xm-pc-dectbl-input-datacheck
  164                 5 process-ssl-adjustment-subp        m-h-table-no900
  165                 5 process-ssl-head-data-edit-sub   m-n-table-no955
  166              4 enter-parts-receipt-data           m-5.8.k
                                                         m-5.10.c.1
  167              4 enter-parts-status-data            m-5.8.x
                                                         m-5.10.c.2
  168              4 enter-parts-usage-data             m-5.8.c.2
  169              4 update-shop-stock-req-status       m-5.10.d.1
  170           3 print-part-number-mismatch-lst     m-4.12.r.1
  171           3 print-reconciltn-exceptn-report    m-4.12.v.1
  172           3 print-shop-stock-list              m-4.12.u
  173           3 print-ssl-constrnt-list            m-4.12.u
  174              4 generate-constraint-report         m-5.10.d.3
  175           3 print-ssl-locator-list             m-4.12.r.2
                                                      m-4.12.u
  176           3 print-supply-activity-reqmnts      m-4.12.r.10
  177           3 print-supply-reports
  178              4 process-prt-no-chg-da-subp
  179              4 process-prt-sta-rcp-sub            m-h-table-no1300
  180           3 print-zero-balance-stock-list      m-4.12.r.4
  181           3 record-parts-status-on-rpf         m-4.12.b
  182           3 record-received-parts
  183           3 generate-monthly-report
  184           3 print-error-exceptn-report         m-4.12.u
  185           3 generate-mpom-transfer-file        m-4.11.o
  186           3 transmit-acceptd-work-orders       m-4.10.e
  187           3 transmit-tech-labor-rpt-form       m-4.10.ff
  188           3 parts-tracking-handling            m-4.12
  189              4 prepare-manual-requisition         m-4.12.1
  190           3 sort-repair-parts-forms-ipd        m-4.12.a
  191           3 transmit-manual-requisition        m-4.12.1
  192           3 transmit-wo-rep-parts-form         m-4.12.b
  193           3 gen-parts-awaiting-disp-action     m-5.10.d.4
  194           3 gen-parts-status-detail-list       m-5.9.m
  195           3 gen-shopstock-zero-balance-rep     m-5.10.d.3
  196           3 gen-supply-activity-req-list       m-5.10.d.4
  197           3 xm-rab-dectbl-input-datacheck
  198        2 maint-equipment-data
```

Figure D-1. LARE Process Structure of the MOM (Cont'd.)

process structure

```
count level name                                    reference
 199        3 record-equip-inspec-data
 200          4 inspect-inop-report                 m-4.7.o
                                                    m-4.7.k
 201          4 print-nors-norm-data                m-4.11.ii
 202          4 annotate-proper-forms               m-4.10.1
 203          4 gen-inoperative-equip-file          m-5.9.f
 204          4 gen-nors-norm-data-listing          m-5.9.s
 205          4 gen-nors-requirements-list          m-5.9.e
 206        3 determine-required-maint
 207          4 determine-required-calibration      m-4.14.e
 208          4 detrmne-required-maint-service      m-4.14.e
 209        3 process-equip-recall
 210          4 gen-equip-recall-delinq-list        m-4.14.m
 211            5 gen-eq-recall-delinquency-list      m-5.12.b
 212          4 gen-equip-recall-schedule           m-4.7.v
                                                    m-4.14.c
                                                    m-5.12.a
 213          4 print-equip-recall-delinq           m-4.7.v.8
                                                    m-4.14.m
 214          4 retrieve-equip-recall-schedule      m-4.14.e
 215          4 change-equip-recall-data            m-5.8.d
 216          4 xm-e-dectbl-input-datacheck
 217          4 process-equip-recall-subproc        m-n-table-no400
 218        3 process-equip-evacuation
 219        3 control-float
 220          4 enter-float-adjustments             m-4.13.j
 221            5 xm-f-dectbl-input-datacheck
 222            5 process-float-file-adjustment       m-n-table-no501
 223          4 indicate-rejected-float-candid
 224          4 issue-float-exchange-notice         m-4.13.g
 225          4 assign-orf-transaction-code         m-4.13.1
 226          4 print-float-candidate-report        m-4.13.1
 227          4 print-float-status-report           m-4.13.k
 228          4 retrv-prev-float-candidate-rep      m-4.13.p
 229          4 compare-float-calcs-params          m-4.13.1
 230          4 change-float-authorization          m-5.8.e
 231          4 enter-float-changes                 m-5.11.f
 232          4 gen-float-candidate-rep             m-5.11.b
                                                    m-5.11.c
                                                    m-5.11.d
```

Figure D-1. LARE Process Structure of the MOM (Cont'd.)

```
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                                          process structure

count level name                                   reference
                                                          m-5.11.e
  233             4 generate-float-status-rep             m-5.11.a
                                                          m-5.11.e
  234          3 enter-equipment-usage-data          m-4.10.jj
  235             4 enter-usage-data                      m-5.8.n
  236             4 gen-usage-data-survey                 m-5.14.b
  237             4 gen-usage-exception-list              m-5.14.c
  238             4 xm-u-xmv-dectbl-input-datachek
  239             4 process-usage-subproc-subp            m-h-table-no1051
  240          3 print-equipment-usage-data
  241          3 process-equipment-usage-data
  242          3 proc-tbl-build-ecc-sta-sto-ing      m-h-table-no1171
  243       2 maint-personnel-data
  244          3 enter-personnel-data-changes        m-4.10.qq
  245          3 print-work-center-summary           m-4.11.b
  246          3 output-magnetic-transfer-media      m-4.11.dd
  247             4 load-labor-util-detail-tape           m-4.11.dd
  248             4 load-transfer-data-file-tape          m-4.11.gq
  249          3 print-labor-util-summary            m-4.11.dd
  250          3 print-workload-status-age-rpt       m-4.11.w
  251          3 change-personnel-assignments        m-5.8.n
  252          3 change-toe-tda-authorization        m-5.8.h
  253          3 gen-labor-utilization-summary       m-5.9.p
  254          3 generate-work-center-summary        m-5.9.p
  255          3 updt-labor-utilization-detail       m-5.9.q
                                                     m-5.9.h
  256          3 xm-l-dectbl-input-datacheck
  257          3 process-wrk-ctr-lbr-edt-subp        m-h-table-no801


level count    level count    level count    level count    level count
    1     1        2     6        3    66        4   120        5    52
    6    11        7     1
```

Figure D-1. LARE Process Structure of the MOM (Cont'd.)

```
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                                  LOGICON LEXINGTON VAX SYSTEM

                                        process structure

parameters for: str

   process indent=3 noindex

count (level or relationship)  names

   1   1 sams-retail-mpom-system
   2      2 manage-support-plan
   3         3 develop-support-plan
   4            4 determine-workload-history
   5         3 maintain-support-plan
   6            4 maintain-workload-data
   7            4 monitor-data-for-reports
   8            4 print-workload-reports
   9         3 accept-key-entries
  10            4 accept-key-report-generation
  11            4 accept-key-date-info
                  rcvs key-entry-inputs-mpom
                  upds report-end-date-ordinal
                  upds report-start-date-ordinal
  12      2 process-work-order-data
  13         3 enter-initial-wo-data
               memo cant-justify-dtm
  14         3 reconcile-wo-parts
               memo cant-justify-nmpf
  15         3 enter-wo-data-update
  16            4 edit-input-transactions
                  memo pv-resolve-errors-offline
  17            4 accept-mom-worf-tprf
                  utlq ident-input-errors
  18            4 update-mpom-files
  19         3 retrieve-wo-data
  20            4 monitor-jobs-awaiting-parts
  21            4 monitor-open-work-orders
  22            4 search-woop-files
  23            4 search-cworf-data-for-rept
                  rcvs key-entry-inputs-mpom
                  trgs compute-turnaround-time-index
                  uses report-end-date-ordinal
                  uses completed-work-order-hist-file
```

Figure D-2. LARE Process Structure of the MPOM

```
                              process structure

count (level or relationship)  names
                  uses report-start-date-ordinal
                  drvs evaluation-hold-file
                  trgd maintn-valid-transaction-file
   24         3 report-wo-status
   25            4 control-report-generation
   26            4 generate-monthly-reports
   27            4 generate-weekly-reports
   28         3 close-out-wo
               memo cant-justify-nmof
   29         3 process-lookup-table-data
   30         3 work-order-transfer
               memo cant-justify-nmof
   31      2 maintain-parts-inventory
   32         3 monitor-repair-parts
   33         3 prnt-critical-spare-parts-lst
   34      2 maintain-equipment-data
   35         3 record-equip-insrec-data
   36         3 determine-required-maint
   37         3 process-equip-recall
   38         3 process-equip-evacuation
   39         3 control-float
   40         3 enter-equipment-usage-data
   41         3 print-equipment-usage-data
   42            4 print-inop-equip-report
                  memo pv-display-by-criteria
   43            4 generate-inop-equip-card
                  memo pf-run-daily
                  trgd sort-with-uic-ecc
   44         3 process-equipment-usage-dta
   45            4 monitor-inoperative-equip
   46            4 update-inop-equipment-file
   47            4 maintain-inop-equipment-data
   48      2 process-task-performance-data
   49         3 sample-task-performance-data
               memo cant-justify-nmof
   50         3 report-task-performance
   51            4 print-maint-cost-summary
                  gens sup-maint-cost-summary-apc
                  trgd record-maint-cost
   52            4 print-support-cost-summary
```

Figure D-2. LARE Process Structure of the MPOM (Cont'd.)

```
                          process structure

count (level or relationship)  names
                      gens support-maint-cost-summ-ecc
                      trgd record-support-maint-cost
                      trgd process-sort-with-cwohf
   53            4 print-maint-evaluation-reports
   54         3 distribute-tpf-data
   55         3 provide-cost-data
   56            4 record-support-maint-cost
                      trgs print-support-cost-summary
   57            4 record-maint-cost
                      trgs print-maint-cost-summary
                      trgd calc-support-maint-cost
   58         3 perform-maintenance-evaluation
   59            4 compute-turnaround-time-index
                      trgs sort-data-by-criteria
                      trgs print-sup-maint-turnover-unit
                      uses evaluation-hold-file
                      trgd search-cwerf-data-for-rept
                      upds evaluation-hold-file
   60            4 sort-data-by-criteria
                      trgs print-sup-maint-turnover-ecc
                      uses evaluation-hold-file
                      uses uic-unit-name-cross-ref-file
                      drvs ecc-turnaround-temp-data
                      trgd compute-turnaround-time-index
   61            4 calc-support-maint-cost
                      trgs record-maint-cost
                      trgd load-data-to-labor-tables
   62      2 maintain-personnel-data
   63         3 monitor-man-hours-applied
   64            4 monitor-unit-activity-manhours
                      trgs print-unit-meantime-repr-mhrs
   65            4 monitor-ecc-meantime-to-repair
                      trgs print-ecc-meantime-repair-rpt
   66         3 report-man-hours-applied
   67            4 print-unit-meantime-repr-mhrs
                      gens supt-maint-mean-time-rep-unit
                      trgd monitor-unit-activity-manhours
   68            4 print-ecc-meantime-repair-rpt
                      gens supt-maint-mean-rep-ecc
                      trgd monitor-ecc-meantime-to-repair
```

Figure D-2. LARE Process Structure of the MPOM (Cont'd.)

```
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                              LOGICON LEXINGTON VAX SYSTEM

                                        process structure

count (level or relationship)  names
   69          3 calculate-labor-costs
   70            4 load-data-to-labor-tables
                   trgs calc-support-maint-cost
                   uses valid-transaction-file
                   uses equipment-category-code
                   uses hourly-rate
                   uses lnor-ovhd-pr-rate-fld
                   uses other-costs
   71            4 process-sort-with-cxonf
                   trgs print-support-cost-summary
                   uses completed-work-order-hist-file
                   uses report-start-date-ordinal


level count   level count   level count   level count   level count
    1     1       2     6       3    29       4    35
```

Figure D-2. LARE Process Structure of the MPOM (Cont'd.)

```
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                              consists matrix report

           workload-status-age-rep-out
           work-order-summary-rep
           work-order-sheet-dist
           work-order-repair-parts-form
           equipment-recall-schedule-out
           work-order-regstr-clsed-out
           work-order-regis-stat-out
           error-exception-report-supply
           output-work-order
           float-candidate-report-out
           equipment-recall-delinq-lst
           management-notification
           inop-equip-report-out
           work-order-copy-two-out
           work-order-copy-three-out
           work-order-copy-one-out
           work-order-copy-four-out
           work-order-copy-five-out
           maint-float-exchange-notifictn
           part-number-mismatch-listing
           rejected-sdc-mrwo
           transfer-file-data-to-mpom
           cust-equip-pickup-notice
           supply-actvity-reqmnts-out
           shop-stock-locator-list
           shop-stock-list-cnstr-rep
           repair-parts-form
           shop-stock-list
           manual-parts-requision-out

      row names                                    column names

    1 documentation-identifier-code  element       1 parts-receipts                 entity
    2 routing-identifier-code        element       2 work-request                   entity
    3 media-and-status-code          element       3 part-number-changes            entity
    4 part-number-field              element       4 work-request-status-form       entity
    5 unit-of-issue                  element       5 intra-shop-work-order          entity
    6 transaction-quantity-received  element       6 work-order                     entity
    7 activity-address-code          element       7 op-readiness-float-item-desc   entity
```

Figure D-3. Sample LARE Consists Matrix (MPOM)

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LOGICON LEXINGTON VAX SYSTEM

consists matrix report

	row names			column names	
8	document-control-number	element	8	work-order-annotations	entity
9	demand-code	element	9	work-order-jacket	entity
10	supplementary-address-code	element	10	sample-data-collection-mrwo	input
11	signal-code	element	11	shipment-status-mag-record	input
12	fund-code	element	12	shop-stock-adj-data-record-a	input
13	weapon-system-designator-code	element	13	shop-stock-adj-data-record-b	input
14	estimated-shipment-date	element	14	repair-part-mortality-data-rec	input
15	issue-priority-designator	element	15	prod-program-mgmt-detrm-inp	input
16	transportation-control-number	element	16	parameter-report-control	input
17	gobiofinu	*** undefined ***	17	shop-supply-list-changes	input
18	mode-of-shipment-code	element	18	shop-supply-listng-adjustments	input
19	day-of-year-avail-for-shipmnt	element	19	soc-repair-parts-data	input
20	file-input-action-code	element	20	soc-work-order-annotations	input
21	card-designator-code-sams	element	21	soc-work-order-changes	input
22	funds-available-designator	element	22	ssl-adj-header-data-record	input
23	account-processing-field	element	23	float-candidate-rejects-input	input
24	project-code	element	24	supply-recon-data-record-an-x	input
25	condition-desig-15-day-table	element	25	supply-recon-data-record-ap-x	input
26	condition-desig-conus-location	element	26	supply-status-magnetic-record	input
27	identifying-number-code	element	27	table-build-data-rec-xm-ya	input
28	item-noun	element	28	table-build-data-rec-xm-yb	input
29	advice-code	element	29	table-build-data-rec-xm-yc	input
30	order-and-shipping-time-var	element	30	table-build-data-rec-xm-yd	input
31	source-maint-and-recovbl-code	element	31	table-build-data-rec-xm-ye	input
32	storage-location-code	element	32	task-definitn-for-init-inspec	input
33	estimated-unit-part-cost	element	33	task-perf-fact-list-semiannual	input
34	unit-id-code-support-unit	element	34	task-perform-factor-list-upd	input
35	liitnu	element	35	task-performance-factor-adj	input
36	identifying-number-code-part	element	36	technician-wo-annotations	input
37	part-number-field-part	element	37	tpf-exception-data-record	input
38	mortality-factor	element	38	personnel-data-changes	input
39	repair-parts-quantity-reqd	element	39	usage-device-component-change	input
40	total-estd-repair-parts-cost	element	40	received-parts-data	input
41	part-source-code	element	41	usage-input-data	input
42	tasefi	element	42	wo-consumptn-data-record-labor	input
43	maint-control-number-sams	element	43	wo-consumptn-data-record-parts	input
44	file-identificatn-number-code	element	44	wo-consumptn-data-record-task	input
45	cond-desig-reports-req	element	45	wo-manhr-consmptn-data-wrksht	input

Figure D-3. Sample LARE Consists Matrix (MPOM) (Cont'd.)

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consists matrix report

row names			column names		
46	product-control-number	element	46	wo-parts-adj-data-record-xm-w	input
47	required-data-source-code	element	47	wo-registration-data-record-a	input
48	hours-expended	element	48	wo-registration-data-record-b	input
49	hours-required	element	49	wo-reqmnts-data-rec-supl-parts	input
50	hours-expended-per-task	element	50	wo-reqmnts-data-record-parts	input
51	suffix-code	element	51	wo-reqmnts-data-record-tasks	input
52	supplementary-address-field	element	52	wo-status-data-record	input
53	dico	*** undefined ***	53	work-center-labr-data-rec-xm-1	input
54	recon-valid-cutof-date-ordinal	element	54	parameter-duty-hours-rec	input
55	supply-status-code	element	55	reconciliatn-response-card-rec	input
56	estimated-delivery-date	element	56	parameter-previous-cycle-rec	input
57	reply-due-date-ordinal	element	57	parts-status-data-record	input
58	transaction-quantity-requested	element	58	parameter-nors-norm-rec	input
59	transaction-day	element	59	bench-stock-listng-change-data	input
60	source-of-sply-cd-rout-id-cd	element	60	annotated-wo-copy-three	input
61	unit-price	element	61	equipment-recall-require	input
62	equipment-category-code	element	62	param-workload-backlog-age	input
63	eqcade	element	63	float-file-adjustment	input
64	work-request-status-code	element	64	calibration-req-by-customer	input
65	work-req-status-description	element	65	alt-sro-requirements	input
66	order-and-shipping-time-ave	element	66	cross-reference-transaction	input
67	ro-qnty	*** undefined ***	67	bench-stock-data-record-xm-pe	input
68	rop-qnty	*** undefined ***	68	bench-stock-data-record-xm-pg	input
69	inquiry-action-code	element	69	bench-stock-data-record-xm-pt	input
70	data-element-abbreviation	element	70	bench-stock-data-record-xm-pd	input
71	work-center-code	element	71	equip-recall-deling-list-reqst	input
72	work-center-description	element	72	xm-a-dectbl-input	input
73	date-prepared-ordinal	element	73	xm-b-dectbl-input	input
74	unit-name-support	element	74	xm-c-dectbl-input	input
75	item-nomen-item-noun-field	element	75	xm-cp-dectbl-input	input
76	identifying-number-code-task	element	76	xm-cs-dectbl-input	input
77	part-number-field-task	element	77	xm-ct-dectbl-input	input
78	planned-task-field	element	78	xm-d-dectbl-input	input
79	tymaac	element	79	xm-dl-dectbl-input	input
80	std-manhours-by-cmnd-tenths	element	80	xm-dp-dectbl-input	input
81	std-manhours-support-tenths	element	81	xm-dt-dectbl-input	input
82	std-manhours-wrk-ctr-tenths	element	82	xm-e-dectbl-input	input
83	ave-mn-expend-work-cent-tenths	element	83	xm-f-dectbl-input	input

Figure D-3. Sample LARE Consists Matrix (MPOM) (Cont'd.)

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LOGICON LEXINGTON VAX SYSTEM

consists matrix report

	row names			column names	
84	standard-manhours-tenths	element	84	xm-g-dectbl-input	input
85	task-completed-status	element	85	xm-h-dectbl-input	input
86	avg-manhours-exp-cmnd-tenths	element	86	xm-i-dectbl-input	input
87	avg-mn-exp-spt-ten	*** undefined ***	87	xm-n-dectbl-input	input
88	hourly-pay-rate	element	88	xm-pa-dectbl-input	input
89	easeloconu	element	89	xm-pb-dectbl-input	input
90	identifying-number-code-comp	element	90	xm-pc-dectbl-input	input
91	part-number-field-component	element	91	xm-pd-dectbl-input	input
92	comp-ser-nu-loc-cont-nu-field	element	92	xm-rab-dectbl-input	input
93	usage-at-removal	element	93	xm-s-dectbl-input	input
94	usage-recorded-when-installed	element	94	xm-t-dectbl-input	input
95	repair-date-ordinal	element	95	xm-u-xmv-dectbl-input	input
96	unit-id-code-customer-unit	element	96	xm-w-dectbl-input	input
97	usage-period-miles	element	97	xm-x-dectbl-input	input
98	usage-period-landings	element	98	xm-y-dectbl-input	input
99	usage-period-hours	element	99	xm-za-dectbl-input	input
100	usage-period-rounds	element	100	xm-zb-dectbl-input	input
101	uspeau	element	101	xm-zc-dectbl-input	input
102	work-order-number	group	102	xm-zd-dectbl-input	input
103	task-or-part-indicator-code	element	103	xm-ze-dectbl-input	input
104	task-sequence-field	element	104	xm-zf-dectbl-input	input
105	type-maint-action-completed	element	105	xm-zg-dectbl-input	input
106	employee-number-field	element	106	xm-zh-dectbl-input	input
107	ordinal-date	element	107	cost-data	input
108	labor-code-worked	element	108	float-adjustments	input
109	labor-distribution-code-suffix	element	109	equipment-recall-new-item-b	input
110	quantity-repaired	element	110	calibration-work-order	input
111	work-center-worked	element	111	parts-receipt-data-record	input
112	manhours-expended-tenths	element	112	maint-prog-data-record	input
113	assignment-code-change	element	113	manual-requistion-data-inp	input
114	taorpinco	*** undefined ***	114	part-number-change-data-rec	input
115	failure-code	element	115	parameter-parts-status-detail	input
116	quantity-consumed-in-maint	element	116	annotated-work-order-copy-tour	input
117	estimated	element	117	maint-prog-reqmnts-data-record	input
118	component-serial-number	element	118	inspector-wo-annotations	input
119	equip-usage-measurement-code	element	119	equipment-recall-new-item-a	input
120	work-order-number-losing	element	120	calibration-required-by-item	input
121	task-sequence-field-losing	element	121	float-status-report-out	output

Figure D-3. Sample LARE Consists Matrix (MPOM) (Cont'd.)

```
CAUSAT Version  3.2R2                                        JAN 26, 1981  09:56:07      page     49
                                   LOGICON LEXINGTON VAX SYSTEM

                                         consists matrix report

                                                                                                                 1
              1 1111111112 2222222223 3333333334 4444444445 5555555556 6666666667 7777777778 8888888889 9999999990
     1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890
    +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  1 1          1***  *    1  ********1*   *   * 1**** * ***1********* 1 **  *****1 *        1          1 *        1
  2 1          1** *      1   ***    1          1         *1          1         *1    *     1       *  1*         1
  3 1          1*         1     *    1          1          1          1          1          1          1          1
  4 1          1****      1   * *    1  *** * * 1**** ** **1*   * *   1* *** ** *1 *   **  *1 **    ** 1** ***    1
  5 1          1** *      1   * *    1  **      1         *1          1         *1    *     1       *  1**        1
    +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  6 1          1*         1   *      1          1          1          1          1          1          1          1
  7 1          1***       1   ***    1          1          1    * *   1     ** **1          1       ***1**    *   1
  8 1          1*         1   * *    1          1        * 1      *   1          1     *    1          1 *        1
  9 1          1** *      1          1          1         *1          1         *1    *     1       *  1*         1
 10 1          1*         1          1          1          1          1          1          1          1          1
    +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
 11 1          1** *      1   * *    1          1         *1          1         *1    *     1       *  1*         1
 12 1          1*         1   * *    1          1          1          1          1          1          1          1
 13 1          1*         1     *    1          1       *  1          1          1  *       1          1          1
 14 1          1*         1     *    1          1          1      *   1          1          1          1          1
 15 1          1**        1 * * *    1          1      *   1          1        **1          1         *1*       * 1
    +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
 16 1          1*         1          1          1          1      *   1          1          1          1 *        1
 17 1          1*         1          1          1          1          1          1          1          1          1
 18 1          1*         1          1          1          1          1          1          1          1          1
 19 1          1*         1          1          1          1          1          1          1          1          1
 20 1          1 **  *    1 *    ****1*   *     1 *** *****1********* 1 **  *****1 ** *** **1**** * *  1**** *****1
    +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
 21 1          1 **  *    1 *    ****1*         1          1   *****  1 *   *****1          1    *  *  1 *    * * 1
 22 1          1 *        1 *        1          1          1          1        **1          1       * *1*         1
 23 1          1 *        1 *        1          1       *  1          1     *  **1  *       1       * *1      *   1
 24 1          1 *        1 * * *    1          1       *  1          1        **1  *       1       * *1          1
 25 1          1 *        1 *      * 1          1          1          1          1          1       * *1          1
    +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
```

Figure D-3. Sample LARE Consists Matrix (MPOM) (Cont'd.)

```
CAUSAT version  3.2K2                              JAN 26, 1981  09:56:07      page     50
                                LOGICON LEXINGTON VAX SYSTEM

                                   consists matrix report

                                                                                                                  1
              1 1111111112 2222222223 3333333334 4444444445 5555555556 6666666667 7777777778 8888888889 9999999990
      1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890 1234567890
     +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  26 I          I *        I *        I          I          I          I        **I          I       * *I*         I
  27 I          I ***      I          I  *** * * I**** ** **I*   * *   I* **  ** *I *  ***  *I***    ** I** ***    I
  28 I          I * *      I          I  **      I  *     **I          I         *I    **    I       *  I*         I
  29 I          I * *      I     *    I          I         *I    *     I         *I    *     I       *  I*         I
  30 I          I *        I          I          I          I          I          I          I       *  I          I
     +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  31 I          I *        I          I          I          I          I         *I          I       *  I          I
  32 I          I **       I          I          I          I          I      *  *I          I       *  I*         I
  33 I          I  **      I          I          I          I          I      *   I          I        * I*         I
  34 I          I   * *    I *      * I* *** *   I*     *   I  ** * *  I*** **    I          I **  **  *I   ** * * I
  35 I          I   *      I          I          I       *  I          I*         I          I          I          I
     +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  36 I          I   *      I          I   *      I          I          I          I          I          I          I
  37 I          I   *      I          I  **      I          I          I          I          I          I          I
  38 I          I   *      I          I          I          I          I          I          I          I          I
  39 I          I   *      I          I          I        **I          I       *  I          I          I          I
  40 I          I   *      I          I          I          I          I          I          I          I          I
     +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  41 I          I   *      I          I          I  *     **I          I          I    *    *I          I          I
  42 I          I   *      I          I          I          I          I          I          I          I          I
  43 I          I   *      I          I          I          I          I          I          I   *      I          I
  44 I          I     *    I          I          I          I          I          I          I          I          I
  45 I          I     *    I          I          I          I          I          I          I          I          I
     +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
  46 I          I     *    I          I          I          I       *  I          I          I          I          I
  47 I          I        * I          I          I          I          I          I          I          I          I
  48 I          I         *I          I          I    *     I          I          I          I          I          I
  49 I          I         *I          I          I          I          I          I          I          I          I
  50 I          I         *I          I          I          I          I          I          I          I          I
     +----------+----------+----------+----------+----------+----------+----------+----------+----------+----------+
```

Figure D-3. Sample LARE Consists Matrix (MPOM) (Cont'd.)

```
CADSAT Version  3.2R2                                         APR 23, 1981  22:54:48      page     37
                              LOGICON LEXINGTON VAX SYSTEM

                                    contents report

parameters for: cont

  file noncflag print-security-information noindex levels=all

   1*    1 mpom-data-inputs (set)
   1      2   wo-data-and-parts-record (input)
   2       3     wo-data-task-section (group)
   3        4       partial-work-order-number (element)
   4        4       task-part-indicator-code (element)
   5        4       task-sequence-field (element)
   6        4       identifying-number-code-task (element)
   7        4       part-number-field-task (element)
   8        4       repair-part-nors-designator (element)
   9        4       planned-task-field (element)
  10        4       component-breakdown-code (element)
  11        4       type-maintenance-action-plnnd (element)
  12        4       quantity-to-be-repaired (element)
  13        4       standard-manhours-tenths (element)
  14        4       work-center-code (element)
  15        4       type-maintenance-action-comp (element)
  16        4       quantity-repaired (element)
  17        4       manhours-expended-tenths (element)
  18        4       manhours-remaining-tenths (element)
  19        4       stndrd-time-data-develop-tech (element)
  20        4       equip-usage-measurement-code (element)
  21        4       usage-recording-when-installed (element)
  22        4       component-serial-number (element)
  23       3     wo-data-parts-section (group)
  24        4       partial-work-order-number (element)
  25        4       task-part-indicator-code (element)
  26        4       task-sequence-field (element)
  27        4       identifying-number-code-part (element)
  28        4       part-number-field-part (element)
  29        4       repair-part-nors-designator (element)
  30        4       item-noun (element)
  31        4       failure-code (element)
  32        4       repair-part-quantity-required (element)
  33        4       part-source-code (element)
  34        4       date-received-original (element)
  35        4       transaction-quantity-issued (element)
```

Figure D-4. Sample LARE Contents Report (MPOM)

```
CADSAT Version  3.2R2                                      APR 23, 1981  22:54:48      page     38
                              LOGICON LEXINGTON VAX SYSTEM

                                        contents report

   36       4      transaction-quantity-requested (element)
   37       4      estimtd-shipment-date-ordinal (element)
   38       4      transaction-quantity-due-in (element)
   39       4      supply-status-code (element)
   40       4      condition-desig-requis-action (element)
   41       4      condition-desig-master-record (element)
   42       4      activity-address-code (element)
   43       4      document-control-number (element)
   44       4      document-ident-code-supply-act (element)
   45       4      date-prepared-ordinal (element)
   46       4      transportation-control-number (element)
   47       4      govt-bill-of-lading-number (element)
   48       4      estimated-ship-date-ordinal (element)
   49       4      routing-identifier-code (element)
   50       4      signal-code (element)
   51       4      advice-code (element)
   52       4      unit-of-issue (element)
   53       4      demand-code (element)
   54       4      weapon-system-designator-code (element)
   55       4      equipment-system-code (element)
   56       4      issue-priority-designator (element)
   57       4      project-code (element)
   58       4      accounting-processing-field (element)
   59       4      quantity-consumed-in-maintnc (element)
   60       4      estimated-unit-parts-cost (element)
   61       4      storage-location-code (element)
   62       4      cond-designator-document-clsd (element)
   63       4      partial-wo-number-previous (element)
   64       4      task-sequence-field-previous (element)
   65       4      cond-designator-change-indic (element)
   66       4      cond-desig-substitute-item (element)
   67       3    wo-data-registration-section (group)
   68       4      work-order-number (element)
   69       4      maint-control-number-sams (element)
   70       4      end-item-component-indic-field (element)
   71       4      item-nomen-item-noun-field (element)
   72       4      identifying-number-code (element)
   73       4      part-number-field (element)
   74       4      equip-serial-local-cont-no-fld (element)
   75       4      equipment-system-code (element)
   76       4      mater-readiness-rept-desig (element)
```

Figure D-4. Sample LARE Contents Report (MPOM) (Cont'd.)

```
                         LOGICON LEXINGTON VAX SYSTEM

                               contents report

 77    4    orf-transaction-code (element)
 78    4    weapn-sys-ser-loc-cont-num-fld (element)
 79    4    part-wo-number-bckup-maint-act (element)
 80    4    registration-serial-number (element)
 81    4    equipment-model-ident-number (element)
 82    4    federal-supply-code-manuf (element)
 83    4    quantity-to-be-repaired (element)
 84    4    init-quantity-to-be-repaired (element)
 85    4    usage-submiss-of-work-req-mil (element)
 86    4    usage-submiss-wo-req-landings (element)
 87    4    usage-submiss-work-req-hours (element)
 88    4    usage-submiss-work-req-rnds (element)
 89    4    usage-submiss-wo-rq-autorttns (element)
 90    4    maintenance-repair-code (element)
 91    4    calibration-level-code (element)
 92    4    maintenance-level-code-unit (element)
 93    4    typ-maint-request-report-code (element)
 94    4    recall-interval-code (element)
 95    4    calibration-interval-code (element)
 96    4    condition-designator-warranty (element)
 97    4    calibration-type-standard-code (element)
 98    4    failure-detected-during-code (element)
 99    4    condition-code (element)
100    4    weapon-system-designator-code (element)
101    4    typ-calibration-report-code (element)
102    4    equipment-utilization-field (element)
103    4    line-item-number (element)
104    4    equipment-category-code (element)
105    4    work-accomplished-code (element)
106    4    accounting-processing-field (element)
107    4    project-code (element)
108    4    maint-sched-strt-date-ord (element)
109    4    maint-sched-comp-date-ord (element)
110    4    on-hand-quantity-for-repair (element)
111    4    quantity-repaired (element)
112    4    maint-mortality-data-desig (element)
113    4    maint-mortality-deter-desig (element)
114    4    manhours-projected-tenths (element)
115    4    manhours-expended-tenths (element)
116    4    manhours-remaining-tenths (element)
117    4    materiel-disposition-code (element)
```

Figure D-4. Sample LARE Contents Report (MPOM) (Cont'd.)

```
                         LOGICON LEXINGTON VAX SYSTEM

                              contents report

118      4       condition-code-completion (element)
119      4       malfunction-description (element)
120      4       work-req-status-code-comp (element)
121      4       work-request-status-code (element)
122      4       ordinal-date (element)
123      4       military-time-of-day (element)
124      4       work-req-status-code-history (element)
125      4       ordinal-date-status-history (element)
126      4       military-time-day-status-hist (element)
127      4       equipment-location (element)
128      4       condition-desig-reimb-custmr (element)
129      4       unit-ident-code-owning-unit (element)
130      4       partial-work-order-number (element)
131      4       eff-on-rsn-cd (element)
132      4       date-acpt-org (element)
133      4       date-completed-ordinal (element)
134      4       unit-ident-code-support-unit (element)
135      4       unit-ident-code-customer-unit (element)
136      4       procurmnt-request-order-number (element)
137     2    weekly-workload-tangmnt-oa-ca (input)
138      3     document-identification-code (element)
139      3     filler (element)
140      3     parameter-critical-part (element)
141      3     parameter-days (element)
142      3     parameter-days-range-field (element)
143      3     equipment-category-code (element)
144     2    weekly-workld-rects-cont-card (input)
145      3     document-identification-code (element)
146      3     filler (element)
147      3     cond-desig-reports-requirement (element)
148      3     equipment-category-code (element)
149     2    transfer-file (input)
150     2    organ-inop-equip-regist-wrksht (input)
151      3     document-identification-code (element)
152      3     partial-wo-number-organization (element)
153      3     file-input-action-code (element)
154      3     work-request-status-code (element)
155      3     ordinal-date (element)
156      3     military-time-of-day (element)
157      3     identifying-number-code (element)
158      3     part-number-field (element)
```

Figure D-4. Sample LARE Contents Report (MPOM) (Cont'd.)

```
CADSAT version  3.2R2                                      APR 24, 1981  19:54:14      page      1
                                   LOGICON LEXINGTON VAX SYSTEM

                                        data process report

parameters for: dp

   file process dpmat dpanl pmat panl


   the rows are data names, the columns are process names.

     row names                                              column names

   1 valid-transaction-file         entity                1 maintain-support-plan           process
   2 workload-status-listing        output                2 maintain-workload-data          process
   3 completed-work-order-hist-file entity                3 maintain-ecc-equip-desc-file    process
   4 work-order-data-and-parts-file entity                4 maintn-uic-unit-crossref-file   process
   5 uic-unit-name-cross-ref-file   entity                5 maint-cust-unit-priority        process
   6 weekly-workload-mangmnt-pa-ca  input                 6 store-xna-xnb-card-data         process
   7 status-temp-file               entity                7 maintn-valid-transaction-file   process
   8 workload-status-list           output                8 purge-old-cworf-data            process
   9 workload-age-listing-out       output                9 monitor-data-for-reports        process
                                                         10 monitor-workload-status         process
                                                         11 monitor-workload-age            process
                                                         12 print-workload-reports          process
                                                         13 print-workload-status-list      process
                                                         14 print-workload-age-list         process
                                                         15 provide-program-status          process
```

Figure D-5. Sample LARE Data Process Report (MPOM)

```
CADSAT Version  3.2R2                                    APR 24, 1981  19:54:14      page     3
                                 LOGICON LEXINGTON VAX SYSTEM

                                      data process report

data process interaction matrix analysis

data
----
valid-transaction-file           (entity)    (row    1) not derived by any process
workload-status-listing          (output)    (row    2) not generated by any process
completed-work-order-hist-file   (entity)    (row    3) not derived by any process
work-order-data-and-parts-file   (entity)    (row    4) not derived by any process
uic-unit-name-cross-ref-file     (entity)    (row    5) not derived by any process
weekly-workload-mangmnt-ra-ca    (input)     (row    6) not received by any process
status-temp-file                 (entity)    (row    7) not derived by any process
workload-status-list             (output)    (row    8) not derived by any process
workload-age-listing-out         (output)    (row    9) not derived by any process

processes
---------
maintain-support-plan                        (column   1) does not interact with any data
maintain-workload-data                       (column   2) does not interact with any data
maintain-ecc-equip-desc-file                 (column   3) does not interact with any data
maintn-uic-unit-crossref-file                (column   4) does not interact with any data
maint-cust-unit-priority                     (column   5) does not interact with any data
store-xna-xnb-card-data                      (column   6) does not interact with any data
maintn-valid-transaction-file                (column   7) uses data, but does not derive or update anything
purge-old-cwork-data                         (column   8) does not interact with any data
monitor-data-for-reports                     (column   9) does not interact with any data
monitor-workload-age                         (column  11) uses data, but does not derive or update anything
print-workload-reports                       (column  12) does not interact with any data
print-workload-status-list                   (column  13) uses data, but does not derive or update anything
provide-program-status                       (column  15) does not interact with any data
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

```
CADSAT Version  3.2R2                                    APR 24, 1981  19:54:14       Page       2
                                 LOGICON LEXINGTON VAX SYSTEM

                                        data process report

data process interaction matrix


(i,j) value    meaning
-----------    --------------------------

     r         row i is received or used by column j (input)
     u         row i is updated by column j
     d         row i is derived or generated by column j (output)
     a         row i is input to, updated by, and output of
                 column j (all)
     f         row i is input to and output of column j (flow)
     1         row i is input to and updated by column j
     2         row i is updated by and output of column j


                     1 1 1 1 1 1
   1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
  +---------+---------+---------+
1 i         i  r      i         i
2 i         i        di         i
3 i         i        ri         i
4 i         i        ri         i
5 i         i        ri         i
  +---------+---------+---------+
6 i         i         ir        i
7 i         i         i    r    i
8 i         i         i    d    i
9 i         i         i      d  i
  +---------+---------+---------+
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

```
CAPSAT Version  3.2R2                                   APR 24, 1981  19:54:14      page      4
                                  LOGICON LEXINGTON VAX SYSTEM

                                      data process report

process interaction matrix (incidence)


the rows and columns are process names from above.
an asterisk in (i,j) means that something derived
or updated by process i is used by process j.


*** matrix empty for rows    1 thru   15 and columns    1 thru   15
```

Figure D-5. Sample [illegible]ARE Data Process Report (MPOM) (Cont'd.)

```
CADSAT Version  3.2R2                                        APR 24, 1981  19:54:14      page       5
                                   LOGICON LEXINGTON VAX SYSTEM

                                       data process report

process interaction matrix analysis

maintain-support-plan               (row/col   1) no interaction, but has subparts and is part of a process
maintain-workload-data              (row/col   2) no interaction, but has subparts and is part of a process
maintain-ecc-equir-desc-file        (row/col   3) no interaction, but is part of another process
maintn-uic-unit-crossref-file       (row/col   4) no interaction, but has subparts and is part of a process
maint-cust-unit-priority            (row/col   5) no interaction, but is part of another process
store-xna-xnb-card-data             (row/col   6) no interaction, but is part of another process
maintn-valid-transaction-file       (row/col   7) no interaction, but is part of another process
purge-old-cworf-data                (row/col   8) no interaction, but is part of another process
monitor-data-for-reports            (row/col   9) no interaction, but has subparts and is part of a process
monitor-workload-status             (row/col  10) no interaction, but is part of another process
monitor-workload-age                (row/col  11) no interaction, but is part of another process
print-workload-reports              (row/col  12) no interaction, but has subparts and is part of a process
print-workload-status-list          (row/col  13) no interaction, but is part of another process
print-workload-age-list             (row/col  14) no interaction, but is part of another process
provide-program-status              (row/col  15) no interaction, but is part of another process
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

```
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                                 LOGICON LEXINGTON VAX SYSTEM

                                      data process report

parameters for: dp

   file data dpmat dpanl pmat panl


   the rows are data names, the columns are process names.

     row names                                              column names

   1 completed-work-order-hist-file entity              1 search-cworf-data-for-rept     process
   2 evaluation-hold-file           entity              2 monitor-workload-status        process
   3 inoperative-equipment-file     entity              3 process-sort-with-cwonf        process
   4 format-data-file               entity              4 compute-turnaround-time-index  process
   5 ecc-turnaround-temp-data       entity              5 sort-data-by-criteria          process
   6 work-order-data-and-parts-file entity              6 ident-input-errors             process
   7 valid-transaction-file         entity              7 print-sup-maint-turnover-ecc   process
   8 ecc-equipment-desc-file        entity              8 generate-weekly-status-rept    process
   9 uic-unit-name-cross-ref-file   entity              9 update-wo-history-file         process
  10 status-temp-file               entity             10 maintn-valid-transaction-file  process
  11 cwoh-outrec-temp-hold          entity             11 load-data-to-labor-tables      process
  12 temporary-hold-file            entity             12 update-uic-crossref-file       process
                                                       13 print-workload-status-list     process
                                                       14 list-input-errors              process
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

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LOGICON LEXINGTON VAX SYSTEM

data process report

data process interaction matrix

(i,j) value	meaning
r	row i is received or used by column j (input)
u	row i is updated by column j
d	row i is derived or generated by column j (output)
a	row i is input to, updated by, and output of column j (all)
f	row i is input to and output of column j (flow)
1	row i is input to and updated by column j
2	row i is updated by and output of column j

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	r	r	r											
2	d			1	r									
3														
4						r								
5					d		r							
6		r						r	r					
7										r	r			
8									r					
9		r			r				r			1		
10								d					r	
11														
12						d								r

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

```
                         data process report

data process interaction matrix analysis

data
----
completed-work-order-hist-file  (entity)   (row   1) not derived by any process
inoperative-equipment-file      (entity)   (row   3) not derived by any process
format-data-file                (entity)   (row   4) not derived by any process
work-order-data-and-parts-file  (entity)   (row   6) not derived by any process
valid-transaction-file          (entity)   (row   7) not derived by any process
ecc-equipment-desc-file         (entity)   (row   8) not derived by any process
uic-unit-name-cross-ref-file    (entity)   (row   9) not derived by any process
cwon-outrec-temp-hold           (entity)   (row  11) not derived by any process

processes
---------
monitor-workload-status                    (column   2) uses data, but does not derive or update anything
process-sort-with-cwonf                    (column   3) uses data, but does not derive or update anything
print-sup-maint-turnover-ecc               (column   7) uses data, but does not derive or update anything
update-wo-history-file                     (column   9) uses data, but does not derive or update anything
maintn-valid-transaction-file              (column  10) uses data, but does not derive or update anything
load-data-to-labor-tables                  (column  11) uses data, but does not derive or update anything
print-workload-status-list                 (column  13) uses data, but does not derive or update anything
list-input-errors                          (column  14) uses data, but does not derive or update anything
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

```
CADSAT Version  3.2R2                                        APR 24, 1981  19:54:14       page     14
                                      LOGICON LEXINGTON VAX SYSTEM

                                           data process report

process interaction matrix (incidence)

the rows and columns are process names from above.
an asterisk in (i,j) means that something derived
or updated by process i is used by process j.

                                           1 1111
                                  1234567890 1234
                                 +----------+----+
                               1 I   **     I    I
                               2 I          I    I
                               3 I          I    I
                               4 I   **     I    I
                               5 I      *   I    I
                                 +----------+----+
                               6 I          I   *I
                               7 I          I    I
                               8 I          I  * I
                               9 I          I    I
                              10 I          I    I
                                 +----------+----+
                              11 I          I    I
                              12 I *  *   * I *  I
                              13 I          I    I
                              14 I          I    I
                                 +----------+----+
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

```
CADSAT Version  3.2R2                                                  APR 24, 1981  19:54:14      page     15
                                   LOGICON LEXINGTON VAX SYSTEM

                                       data process report

process interaction matrix analysis

search-cworf-data-for-rept                  (row/col   1) no predecessors for this process
monitor-workload-status                     (row/col   2) no successors for this process
process-sort-with-cwonf                     (row/col   3) no interaction, but is part of another process
ident-input-errors                          (row/col   6) no predecessors for this process
print-sup-maint-turnover-ecc                (row/col   7) no successors for this process
generate-weekly-status-rept                 (row/col   8) no predecessors for this process
update-wo-history-file                      (row/col   9) no successors for this process
maintn-valid-transaction-file               (row/col  10) no interaction, but is part of another process
load-data-to-labor-tables                   (row/col  11) no interaction, but is part of another process
print-workload-status-list                  (row/col  13) no successors for this process
list-input-errors                           (row/col  14) no successors for this process
```

Figure D-5. Sample LARE Data Process Report (MPOM) (Cont'd.)

AIRMICS PROGRAM REV-PERIOD 0 DATE 24 APR 81 PAGE 1

LOGICON MAINTENANCE PROGRAM OPERATIONS MANAGMENT DATA BASE STATUS REPORT

REQ. NO.	REQUIREMENT NAME	SYNONYM	TYPE	CAT	SEQN	STAT	NREV	SY	DS	SR	KW	TK	UD	RG	TT	UU	MM	OR
4.1	NOT FOUND IN DB																	
4.1.a	NOT FOUND IN DB																	
4.1.b	NOT FOUND IN DB																	
4.2	NOT FOUND IN DB																	
4.2.a	manage-support-plan	masp	proc			compl	0	1	1	2	0	0	00	00	00	00	0	4
4.2.a.1	develop-support-plan	desupl	proc			compl	0	1	1	1	0	0	00	00	00	00	0	2
	maintain-support-plan	masupl	proc			compl	0	1	1	1	0	0	00	00	00	00	0	4
4.2.a.2	NOT FOUND IN DB																	
4.2.b	determine-workload-history	dewohi	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
	maintain-workload-data	mawoda	proc			compl	0	1	1	1	0	0	00	00	00	00	0	6
4.2.c	NOT FOUND IN DB																	
4.2.d	edit-input-transactions	edintr	proc			compl	0	1	1	2	0	0	00	00	00	00	1	4
	list-input-errors	liiner	proc			compl	0	1	1	2	0	0	10	00	30	00	1	1
	ident-input-errors	idiner	proc			compl	0	1	1	2	0	0	11	50	14	01	0	1
4.3	update-wo-history-file	upwohifi	proc			compl	0	1	1	1	0	0	30	00	14	01	0	1
	status-temp-file		grup			compl	0	0	0	2	0	0	00	00	00	00	0	3
	update-comp-wo-hist-file	upcowohifi	proc			compl	0	1	1	4	0	0	00	00	00	00	0	1
	generate-weekly-reports	gewere	proc			compl	0	1	1	1	0	0	00	00	00	00	0	4
4.3.a	control-report-generation	corege	proc			compl	0	1	1	3	0	0	00	00	00	00	0	3
	update-uic-crossref-file	upuicrfi	proc			compl	0	1	1	1	0	0	20	00	12	02	0	2
	update-ecc-equip-desc-file		proc			compl	0	0	1	1	0	0	00	00	00	00	0	1
4.3.b	accept-mom-inputs	acmoin	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
	accept-supply-status-files	acsustfi	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
4.3.c	accept-mom-worf-torf	acmowotp	proc			compl	0	1	1	1	0	0	00	00	00	10	0	1
4.3.d	accept-wrkld-mgmnt-cntrl-card	acwrmgcnca	proc			compl	0	1	1	2	0	0	00	00	10	10	1	1
	update-comp-wo-hist-file	upcowohifi	proc			compl	0	1	1	4	0	0	00	00	00	00	0	1
	generate-monthly-reports	gemore	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
4.3.e	control-report-generation	corege	proc			compl	0	1	1	3	0	0	00	00	00	00	0	3
	accept-wrkld-mgmnt-cntrl-card	acwrmgcnca	proc			compl	0	1	1	2	0	0	00	00	10	10	1	1
4.3.f	battalion-mato-dio	bamadi	intf			compl	0	1	0	1	0	0	00	00	00	00	0	0
	print-workload-status-list	prwostli	proc			compl	0	1	1	1	0	0	10	01	20	00	0	1
	monitor-workload-status	mowost	proc			compl	0	1	1	1	0	0	31	00	12	00	0	1
	generate-weekly-status-rept		proc			compl	0	0	0	2	0	0	11	00	11	00	0	1
4.3.g	monitor-workload-age	mowoag	proc			compl	0	1	1	1	0	0	10	00	00	10	0	1
	print-workload-age-list	prwoagli	proc			compl	0	1	1	1	0	0	00	01	10	01	0	1
4.3.h	monitor-repair-parts	morepa	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
	prnt-critical-spare-parts-lst	prcrsppals	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
4.3.i	monitor-jobs-awaiting-parts	mojowpa	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1

Figure D-6. Sample LARE Data Base Report (MPOM)

AIRMICS PROGRAM	REV-PERIOD 0	DATE 24 APR 81	PAGE 2

LOGICON MAINTENANCE PROGRAM OPERATIONS MANAGMENT DATA BASE STATUS REPORT

REQ. NO.	REQUIREMENT NAME	SYNONYM	TYPE	CAT	SEQN	STAT	NREV	SY	DS	SR	KW	TK	UD	RG	TT	UU	MM	OR
	print-sumt-maint-detail-list	prsumadeli	proc			compl	0	1	1	1	0	0	00	00	10	00	0	1
4.3.j	ecc-commodity-manager	eccoma	intf			compl	0	1	0	2	0	0	00	00	00	00	0	1
	monitor-open-work-orders	moowoor	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
4.3.k	provide-program-status	prprst	proc			compl	0	1	1	1	0	0	00	00	10	00	0	1
4.4	generate-inop-equip-card	geineqca	proc			compl	0	1	1	2	0	0	00	00	10	00	1	1
	print-inop-equip-report	prineqre	proc			compl	0	1	1	1	0	0	00	00	00	00	1	3
	monitor-inoperative-equip	moineq	proc			compl	0	1	1	1	0	0	00	00	00	00	0	3
4.4.a	keypunch-operator	keop	xxxx			compl	0	1	0	1	0	0	00	00	00	00	0	1
4.4.b	maintain-ecc-equip-desc-file	maeceqdefi	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
	update-inop-equipment-file	upineqfi	proc			compl	0	1	1	1	0	0	00	00	00	00	0	6
	maintn-uic-unit-crossref-file	mauiuncrfi	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
	maintain-inop-equipment-data	maineqda	proc			compl	0	1	1	2	0	0	00	00	00	00	0	3
	accept-mor-inputs	acmoin	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
	accept-supply-status-files	acsustfi	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
4.4.c	print-inop-equip-rept-unit	prineqreun	proc			compl	0	1	1	1	0	0	01	00	00	00	0	1
4.4.d	print-inop-equip-rept-ecc	prineqreec	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
4.4.e	generate-inop-equip-card	geineqca	proc			compl	0	1	1	2	0	0	00	00	10	00	1	1
4.5	NOT FOUND IN DB																	
4.5.a	NOT FOUND IN DB																	
4.5.b	calc-support-maint-cost	cacumaco	proc			compl	0	1	1	5	0	0	00	00	11	00	0	1
4.5.c	calc-support-maint-cost	cacumaco	proc			compl	0	1	1	5	0	0	00	00	11	00	0	1
4.5.d	calc-support-maint-cost	cacumaco	proc			compl	0	1	1	5	0	0	00	00	11	00	0	1
4.5.e	print-support-cost-summary	prsucosu	proc			compl	0	1	1	2	0	0	00	01	20	00	0	1
	record-support-maint-cost	resumaco	proc			compl	0	1	1	1	0	0	00	00	01	00	0	1
	calc-support-maint-cost	cacumaco	proc			compl	0	1	1	5	0	0	00	00	11	00	0	1
4.5.f	print-maint-cost-summary	prmacosu	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
	record-maint-cost	remaco	proc			compl	0	1	1	1	0	0	00	00	11	00	0	1
	calc-support-maint-cost	cacumaco	proc			compl	0	1	1	5	0	0	00	00	11	00	0	1
4.6	perform-maintenance-evaluation	pemaev	proc			compl	0	1	1	1	0	0	00	00	00	00	0	4
	print-maint-evaluation-reports	prmaevre	proc			compl	0	1	1	2	0	0	00	00	00	00	0	3
	generate-monthly-reports	gemore	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
4.6.a	compute-turnaround-time-index	cotutiin	proc			compl	0	1	1	2	0	0	10	00	12	00	0	2
	print-sum-maint-turnover-unit	prsumatuun	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
4.6.b	print-sum-maint-turnover-ecc	prsumatuec	proc			compl	0	1	1	2	0	0	10	01	10	00	0	1
	sort-data-by-criteria	sodabycr	proc			compl	0	1	1	2	0	0	21	00	11	00	0	1
4.6.c	monitor-unit-activity-manhours	mounacma	proc			compl	0	1	1	1	0	0	00	00	01	00	0	1
	print-unit-[illegible]	[illegible]	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
4.6.d	accept-maint-eval-control-card	acmaevcoca	proc			compl	0	1	1	2	0	0	00	00	10	00	0	1

Figure D-6. Sample LARE Data Base Report (MPOM) (Cont'd.)

LOGICOM MAINTENANCE PROGRAM OPERATIONS MANAGMENT DATA BASE STATUS REPORT

REQ. NO.	REQUIREMENT NAME	SYNONYM	TYPE	CAT	SEQN	STAT	NREV	SY	DS	SR	KW	TK	UD	RG	TT	UU	MM	OR
	print-ecc-meantime-repair-rpt	precmerero	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
	monitor-ecc-meantime-to-repair	moecmetore	proc			compl	0	1	1	1	0	0	00	00	01	00	0	1
4.5.e	control-report-generation	corege	proc			compl	0	1	1	3	0	0	00	00	00	00	0	3
	accept-maint-eval-control-card	acmaevcoca	proc			compl	0	1	1	2	0	0	00	00	10	00	0	1
4.7	edit-input-transactions	edintr	proc			compl	0	1	1	2	0	0	00	00	00	00	1	4
4.7.a	ident-input-errors	idiner	proc			compl	0	1	1	2	0	0	11	50	14	01	0	1
	list-input-errors	liiner	proc			compl	0	1	1	2	0	0	10	00	30	00	1	1
4.7.b	NOT FOUND IN DB																	
5.1	NOT FOUND IN DB																	
5.1.a	NOT FOUND IN DB																	
5.1.a.1	NOT FOUND IN DB																	
5.1.a.2	NOT FOUND IN DB																	
5.1.b	NOT FOUND IN DB																	
5.2	NOT FOUND IN DB																	
5.3	update-comp-wo-hist-file	upcowohifi	proc			compl	0	1	1	4	0	0	00	00	00	00	0	1
5.3.a	store-xna-xnb-card-data	stxnxncada	proc			compl	0	1	1	1	0	0	00	00	01	00	0	1
5.3.b	search-for-ecc-match	sefoecma	proc			compl	0	1	1	1	0	0	00	00	00	10	0	1
	search-addr-files	seadfi	proc			compl	0	1	1	1	0	0	00	00	00	00	0	5
5.3.c	update-comp-eo-hist-file	upcoeohifi	proc			compl	0	1	1	4	0	0	00	00	00	00	0	1
5.3.d	search-for-uic	sefoui	proc			compl	0	1	1	1	0	0	00	00	00	10	0	1
5.3.e	search-for-workload-age		proc			compl	0	0	1	1	0	0	00	00	00	00	0	1
5.3.f	search-for-status	sefost	proc			compl	0	1	1	2	0	0	00	00	00	00	0	1
5.3.g	NOT FOUND IN DB																	
5.3.h	NOT FOUND IN DB																	
5.4	maintain-ipop-equipment-data	maipeqda	proc			compl	0	1	1	2	0	0	00	00	00	00	0	3
5.4.a	maintn-valid-transaction-file	mavatrfi	proc			compl	0	1	1	4	0	0	10	00	01	00	0	1
	search-valid-transac-file	sevatrfi	proc			compl	0	1	1	1	0	0	00	00	02	00	0	1
5.4.a.1	create-new-parts-records	crnepare	proc			compl	0	1	1	1	0	0	00	00	11	00	0	1
5.4.a.2	overlay-esd-on-ief	ovesonie	proc			compl	0	1	1	1	0	0	00	00	00	00	1	1
5.4.b	sort-ipop-status-data	soipstda	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
5.4.c	sort-match-supply-status-file	somasustfi	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
5.4.d	add-delete-records-on-flag	addereonfl	proc			compl	0	1	1	1	0	0	00	00	01	00	0	1
5.4.e	sort-with-uic-ecc	sowiuiec	proc			compl	0	1	1	1	0	0	00	00	11	00	0	1
5.5	calculate-labor-costs	calaco	proc			compl	0	1	1	1	0	0	00	00	00	00	0	3
5.5.a	load-data-to-labor-tables	lodatolata	proc			compl	0	1	1	1	0	0	50	00	01	00	0	1
	maintn-valid-transaction-file	mavatrfi	proc			compl	0	1	1	4	0	0	10	00	01	00	0	1
5.5.b.	NOT FOUND IN DB																	
5.5.c	NOT FOUND IN DB																	

Figure D-6. Sample LARE Data Base Report (MPOM) (Cont'd.)

LOGICON MAINTENANCE PROGRAM OPERATIONS MANAGMENT DATA BASE STATUS REPORT

REQ. NO.	REQUIREMENT NAME	SYNONYM	TYPE	CAT	SEQN	STAT	NREV	SY	DS	SR	KW	TK	UD	FG	TT	UU	MM	OR
5.5.d	print-maint-cost-summary	prmacosu	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
	print-support-cost-summary	prsucosu	proc			compl	0	1	1	2	0	0	00	01	20	00	0	1
5.6	print-maint-evaluation-reports	prmaevre	proc			compl	0	1	1	2	0	0	00	00	00	00	0	3
5.6.a	mainto-valid-transaction-file	mavatrfi	proc			compl	0	1	1	4	0	0	10	00	01	00	0	1
5.6.b	key-entry-inputs-mon	keeninmp	xxxx			compl	0	1	0	1	0	0	00	00	00	00	0	5
	report-end-date-ordinal		elem			compl	0	0	0	1	0	0	00	00	00	00	0	3
	search-cvorf-data-for-rept	secvdafore	proc			compl	0	1	0	1	0	0	31	10	11	00	0	1
	report-start-date-ordinal	rept-str-date-o	elem			compl	0	1	1	6	0	0	00	00	00	00	1	9
5.6.c	compute-turnaround-time-index	cotutiin	proc			compl	0	1	1	2	0	0	10	00	12	00	0	2
	evaluation-hold-file	evhofi	grup			compl	0	1	1	2	0	0	00	00	00	00	0	14
	sort-data-by-criteria	sodabycr	proc			compl	0	1	1	2	0	0	21	00	11	00	0	1
5.6.d	print-sup-maint-turnover-unit	prsumatuun	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
5.6.d.1	print-sup-maint-turnover-ecc	prsumatuec	proc			compl	0	1	1	2	0	0	10	01	10	00	0	1
5.6.d.2	print-unit-meantime-repr-hrs	prunmeremh	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
5.6.d.3	print-ecc-meantime-repair-rpt	precmererp	proc			compl	0	1	1	2	0	0	00	01	10	00	0	1
5.6.e	purge-old-cvorf-data	puolcvda	proc			compl	0	1	1	1	0	0	00	00	00	00	0	1
5.7	update-valid-transaction-file	upvatrfi	proc			compl	0	1	1	2	0	0	00	00	10	00	0	1
	mainto-valid-transaction-file	mavatrfi	proc			compl	0	1	1	4	0	0	10	00	01	00	0	1
5.7.a	update-valid-transaction-file	upvatrfi	proc			compl	0	1	1	2	0	0	00	00	10	00	0	1
5.7.b	NOT FOUND IN DB																	
5.7.c	NOT FOUND IN DB																	

Figure D-6. Sample LARE Data Base Report (MPOM) (Cont'd.)

AIRMICS PROGRAM DATE 24 APR 81

LOGICON MAINTENANCE PROGRAM OPERATIONS MANAGMENT DATA BASE SUMMARY REPORT

TYPES OF INFORMATION	NO. REQUIRED	NO. PRESENT	NO. OMITTED
synonyms		109	
descriptions		106	
sources		215	
keywords		0	
trace keys	114	0	114
uses		35	
derives		8	
receives		11	
generates		14	
triggereds	114	52	69
triggers	114	44	64
utilizeds		6	
utilizes		6	
memos		11	
others		108	
STATUS SUMMARY:			
ambig		0	
incpl		0	
incon		0	
descr		0	
redun		0	
compl		114	
REVISION SUMMARY:			
RECENT		0	
TOTAL		0	

Figure D-6. Sample LARE Data Base Report (MPOM) (Cont'd.)

```
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                                  LOGICON LEXINGTON VAX SYSTEM

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parameters for: tos

   file noindex print empty norunch smarg=5 nmarg=20 amarg=10 hmarg=25 rnmarg=70 cmarg=1 hmarg=40
   nodesignate one-per-line define comment none*-page none*-line noall-statements
   complementary-statements line-numbers printeof

  input                                  cross-ref-transaction;
      synonyms are:  crretr;
      attributes are:
           document-code-identifier
                          xrx,
           frequency      monthly-30,
           media          magnetic;
      consists of:
                          document-identification-code,
                          file-input-action-code,
                          card-designator-code-SAMS,
                          unit-ident-code-support-unit,
                          filler,
                          unit-name-support,
                          unit-ident-code-parent-unit,
                          unit-name-parent,
                          conditn-designtr-rastr-recrd,
                          activity-address-code,
                          accounting-processing-field,
                          unit-name-customer;
      contained in:  mpom-data-inputs;
      used by:       update-uic-crossref-file;
      source is:     p-a.13.05.Ry;

  input                                  supply-status-card-record;
      synonyms are:  sustcare;
      see-memo:      of-proc-prior-to-as-au-cards;
      attributes are:
           frequency      weekly-200,
           document-code-identifier
                          ae_;
      received by:   ident-input-errors;
      consists of:
                          document-identification-code,
                          routing-identifier-code,
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM)

```
                         formatted problem statement

                                  media-and-status-code,
                                  part-number-field,
                                  unit-of-issue,
                                  transaction-quantity-requested,
                                  activity-address-code,
                                  document-control-number,
                                  suffix-code,
                                  supplementary-address-field,
                                  signal-code,
                                  fund-code,
                                  distribution-code,
                                  project-code,
                                  issue-priority-designator,
                                  transaction-day,
                                  supply-status-code,
                                  source-supply-code-route-id-cd,
                                  estimated-shipment-date,
                                  unit-price;
       contained in:  mpom-data-inputs;
       source is:     p-a.13.15.1r;

input                                    key-entry-inputs-mpom;
       synonyms are:  keeninp;
       generated by:  key-operator;
       received by:   accept-key-date-info,
                      search-c*orf-data-for-rent;
       consists of:
                                  report-end-date-ordinal,
                                  report-start-date-ordinal;
       contained in:  mpom-data-inputs;
       source is:     p-5.6.p;

input                                    month-fin-mangmnt-rpt-cnt-card;
       synonyms are:  mofimarrcn;
       attributes are:
            document-code-identifier
                                  xre,
            frequency             monthly,
            volume-per-month
                                  one-per-process;
       consists of:
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

formatted problem statement

```
                         document-identification-code,
                         conn-iso-rept-rqmt,
                         filler;
   contained in:  mpom-data-inputs;
   source is:     p-a.13.22.1r;

input                              key-operator-inputs;
   generated by:  key-crt-operator;

input                              inop-equip-status-data-file;
   synonyms are:  ineqstdatl;
   see-memo:      pf-forwarded-to-mpom-from-mom,
                  pf-proc-prior-to-using-inop-fl;
   attributes are:
        frequency       daily-200,
        document-code-identifier
                        xmj,
        media           magnetic;
   consists of:
                        document-identification-code,
                        partial-work-order-number,
                        filler,
                        work-request-status-code,
                        ordinal-date,
                        military-time-of-day,
                        identifying-number-code,
                        part-number-field,
                        malfunction-description,
                        date-accepted-ordinal,
                        issue-priority-designator,
                        maintenance-repair-code,
                        part-xo-number-tckup-maint-act,
                        manhours-remaining-tenths,
                        equipment-category-code,
                        mater-readiness-rept-desig,
                        activity-address-code,
                        item-noun,
                        part-source-code,
                        supply-status-code,
                        transaction-date-ordinal,
                        transaction-quantity-required,
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

formatted problem statement

```
                      estimtd-shipment-date-ordinal;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.14.9d;

input                             weekly-workld-repts-cont-card;
    synonyms are:  weworecoca;
    see-memo:      pf-process-before-normal-cycl;
    attributes are:
         frequency        possible-1-per-cycle,
         document-code-identifier
                      xnb;
    received by:   ident-input-errors;
    consists of:
                      document-identification-code,
                      filler,
                      cond-desig-reports-requirement,
                      equipment-category-code;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.04.1r;

input                             shipment-status-card-record;
    synonyms are:  shstcare;
    see-memo:      ds-proc-after-ae-prior-au;
    attributes are:
         frequency        weekly-500,
         document-code-identifier
                      as_;
    received by:   ident-input-errors;
    consists of:
                      document-identification-code,
                      routing-identifier-code,
                      media-and-status-code,
                      part-number-field,
                      unit-of-issue,
                      transaction-quantity-requested,
                      activity-address-code,
                      document-control-number,
                      suffix-code,
                      supplementary-address-field,
                      signal-code,
                      fund-code,
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

formatted problem statement

```
                             distribution-code,
                             estimated-shipment-date,
                             issue-priority-designator,
                             transportation-control-number,
                             mode-of-shipment,
                             date-shipped;
   contained in:  mpom-data-inputs;
   source is:     p-a.13.16.1r;

input                                  transfer-file;
   synonyms are:  trfl;
   description:
 For Transfer File (13.07.8w) those DICs not used for this phase of MOM,
 will be used in subsequent phases. Card images of input files in order:
 XME(a,b) XMF,XML,XMV,XMT,XMV,and XMX(a,b).
 XMX is used in the MPOM 13.05.8y weekly workload Management Process.;
   see-memo:      of-proc-prior-to-cycle;
   attributes are:
        frequency       weekly,
        media           magnetic;
   contained in:  mpom-data-inputs;
   source is:     p-a.13.07.8w;

input                                  ship-stat-card-reply-cnc-re;
   synonyms are:  shstcarecn;
   see-memo:      of-proc-after-ae-as;
   attributes are:
        document-code-identifier
                             au_,
        frequency       weekly-100;
   received by:   ident-input-errors;
   consists of:
                             document-identification-code,
                             routing-identifier-code,
                             media-and-status-code,
                             part-number-field,
                             unit-of-issue,
                             transaction-quantity-requested,
                             activity-address-code,
                             document-control-number,
                             suffix-code,
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

formatted problem statement

```
                          supplementary-address-field,
                          signal-code,
                          fund-code,
                          distribution-code,
                          estimated-shipment-date,
                          issue-priority-designator,
                          transportation-control-number,
                          mode-of-shipment,
                          date-shipped;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.17.1r;

input                                 support-maint-eval-rept-ct-crd;
    synonyms are:  sumeevrect;
    attributes are:
         document-code-identifier
                          xnf,
         frequency        monthly;
    consists of:
                          document-identification-code,
                          filler,
                          cond-dsg-rept-rqmt,
                          equipment-category-code;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.31.1r;

input                                 ecc-cross-reference-data-recod;
    synonyms are:  eccrredare;
    see-memo:      pf-post-to-data-base-on-rcpt,
                   pf-proc-before-other-user-prcs;
    attributes are:
         document-code-identifier
                          xnc,
         frequency        as-required,
         volume-per-month
                          *20,
         media            magnetic;
    consists of:
                          document-identification-code,
                          file-input-action-code,
                          equipment-category-code,
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

formatted problem statement

```
                         equipment-category-description;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.06.9v;

input                                   wo-data-and-parts-record;
    synonyms are:  wodaanpare;
    attributes are:
         frequency       weekly,
         volume-per-month
                         rec3100/cna170-rec500/cna500;
    consists of:
                         wo-data-task-section,
                         wo-data-parts-section,
                         wo-data-registration-section;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.01.3*;

input                                   organ-inop-equip-regist-wrksht;
    synonyms are:  orinegre*r;
    see-memo:      pf-proc-prior-to-xmk;
    attributes are:
         document-code-identifier
                         xmj,
         frequency       weekly-1000;
    consists of:
                         document-identification-code,
                         partial-wo-number-organization,
                         file-input-action-code,
                         work-request-status-code,
                         ordinal-date,
                         military-time-of-day,
                         identifying-number-code,
                         part-number-field,
                         item-noun,
                         equip-ser-lcl-con-no-fld,
                         maintenance-repair-code,
                         reason-inoperative,
                         partial-work-order-number,
                         equipment-category-code,
                         mater-readiness-rept-desig;
    contained in:  mpom-data-inputs;
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

```
    source is:     p-a.13.11.4d;

input                                  supply-status-file-record;
    synonyms are:  sustfire;
    attributes are:
         frequency      weekly-2000-4000,
         media          magnetic;
    consists of:
                        document-identification-code,
                        routing-identifier-code,
                        media-and-status-code,
                        part-number-field,
                        unit-of-issue,
                        transaction-quantity-requested,
                        activity-address-code,
                        document-control-number,
                        estimated-shipment-date,
                        suffix-code,
                        supplementary-address-field,
                        signal-code,
                        fund-code,
                        distribution-code,
                        project-code,
                        issue-priority-designator,
                        transaction-day,
                        supply-status-code,
                        source-supply-code-route-id-cd,
                        unit-price,
                        transportation-control-number,
                        mode-of-shipment,
                        date-shipped;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.13.8v;

input                                  org-inop-eq-parts-data-wk-rcd;
    synonyms are:  orinegdata;
    see-memo:      of-process-after-xrl-inps;
    attributes are:
         document-code-identifier
                        xrk,
         frequency      daily-200;
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

formatted problem statement

```
    consists of:
                         document-identification-code,
                         partial-wo-number-organization,
                         file-input-action-code,
                         activity-address-code,
                         document-control-number,
                         item-noun,
                         identifying-number-code,
                         part-number-field,
                         part-source-code,
                         issue-priority-designator,
                         supply-status-code,
                         transaction-date-ordinal,
                         transaction-quantity-required,
                         estimtd-shipment-date-ordinal,
                         filler;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.12.4d;

input                                  direct-indirect-lab-otn-crd;
    synonyms are:  diinlaovot;
    attributes are:
         document-code-identifier
                         xnd,
         volume-per-month
                         varies;
    consists of:
                         document-identification-code,
                         filler,
                         equipment-category-code,
                         hourly-rate,
                         indirect-oh-hourly-rate-field,
                         reserved,
                         other-costs;
    contained in:  mpom-data-inputs;
    source is:     p-a.13.21.1r;

input                                  weekly-workload-mangmnt-pa-ca;
    synonyms are:  wewomaraca;
    see-memo:      of-proc-prior-to-prog-cycles;
    attributes are:
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

```
                         LOGICON LEXINGTON VAX SYSTEM

                          formatted problem statement

          document-code-identifier
                              xna,
          frequency           weekly-1;
     received by:   ident-input-errors;
     consists of:
                              document-identification-code,
                              filler,
                              parameter-critical-part,
                              parameter-days,
                              parameter-days-range-field,
                              equipment-category-code;
     contained in:  mpom-data-inputs;
     used by:       monitor-workload-age;
     source is:     p-a.13.03.1r;

input                                 org-inop-equip-req-data-record;
     synonyms are:  orineqreda;
     see-memo:      of-process-prior-to-xmk;
     attributes are:
          frequency           daily-200,
          document-code-identifier
                              xm1;
     consists of:
                              document-identification-code,
                              partial-work-order-number,
                              file-input-action-code,
                              work-request-status-code,
                              ordinal-date,
                              military-time-of-day,
                              identifying-number-code,
                              part-number-field,
                              item-noun,
                              equip-serial-local-cont-no-fld,
                              equip-ser-lcl-con-no-fld,
                              maintenance-repair-code,
                              reason-inoperative,
                              equipment-category-code,
                              mater-readiness-rept-desig;
     contained in:  mpom-data-inputs;
     source is:     p-a.13.13.4d;
```

Figure D-7. Sample LARE Formatted Problem Statement (MPOM) (Cont'd.)

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name list

	name	type	synonym	paragraph
67	assignment-change-code	element		m-a,12,04,kz,fld,16
68	assignment-code-change	element	ascoch	
69	author-quant-on-readiness-flt	element	athrzd-qntv-orf	m-a,12,40,kv,fld,7
			auquoprefl	m-b,o2,10,4v,fld,6
70	autortn-usg-at-sbms-of-wrk-req	element	auusatsbof	m-a,12,02,kz,fld,14
			use-sbm-wrk-req-autortns	m-a,12,02,kz,fld,14
71	ave-mh-expend-work-cent-tenths	element	avg-mh-exp-wrk-cen-ten	m-a,12,62,4y,fld,15
			avmaexwoce	m-a,12,62,4y,fld,15
72	average-monthly-issued-ssl	element		m-b,o2,41,4y,fld,21
			avg-mo-isd-ssl	m-b,o2,39,4m,fld,23a
			avmoisss	m-b,o2,41,4y,fld,9
73	avg-manhours-exp-cmnd-tenths	element	avg-mh-exp-cmd-ten	m-a,12,63,4m,fld,11
			avmaexcote	m-a,12,63,4m,fld,11
74	avg-manhours-exp-supp-tenths	element	avg-mh-exp-spt-ten	
75	back-status-sub-equip-cat-rep	output	bastsueqca	m-b,o2,03,4d
76	back-up-maintenance-activity	interface	baupmaac	
			bma	
77	backlog-age-by-equip-cat-rep	output	baagbyeqca	m-b,o2,03,4d
78	backlog-status-subsection-rep	output	bastsure	m-b,o2,03,4d
79	backup-maintenance-activity	interface	bamaac	m-4,20,a
80	battalion-management	interface	bama	
81	battalion-materiel-office	interface		
82	bench-stock-adjustment-data	set	bestad	m-a,12,17,kv
83	bench-stock-data-record-xm-pd	input	bestdarexmpd	
84	bench-stock-data-record-xm-pe	input	bestdarexmpe	
85	bench-stock-data-record-xm-pf	input	bestdarexmpf	
86	bench-stock-data-record-xm-pg	input	bestdarexmpg	
87	bench-stock-list	set	bestli	
88	bench-stock-list-report	output	bestlire	m-b,o2,42,4v
89	bench-stock-listing-file	set	bestlifi	m-4,12,a
			bslf	m-4,12,a
90	bench-stock-listng-change-data	input	bestlichda	
91	bma-control-activity	interface	bmcoac	
92	cadecopa	*** undefined ***		
93	calbr-cd	*** undefined ***		
94	calibration-interval-code	element	cainco	m-a,12,31,4q,fld,13
			calbr-intrvl-cd	m-a,12,32,4q,fld,14
95	calibration-level-code	element	calbr-lvl-cd	m-a,12,31,4q,fld,12
			caleco	m-a,12,32,4q,fld,13

Figure D-8. Sample LARE Name List (MOM)

```
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                                   LOGICON LEXINGTON VAX SYSTEM

                                          name list

      name                                type              synonym                 paragraph

 96   calibration-req-by-customer         input             carebycu
 97   calibration-required-by-item        input             carebyit
 98   calibration-requirements-data       set               careda                  m-a,12,31,4q
 99   calibration-team-clerk              interface         catecl
100   calibration-team-levela             interface         catele
101   calibration-technician              interface         cate
102   calibration-type-standard-code      element           calbr-type-std-cd
                                                            catystco
103   calibration-work-center             interface         cawoce                  m-4,14,q,3
104   calibration-work-order              input             cawoor                  m-14,h,1
105   card-designator-code-sams           element                                   m-a,12,97,ky,fld,2
                                                                                    m-a,12,98,ky,fld,3
                                                                                    m-a,12,30,ky,fld,3
                                                                                    m-a,12,98,fld,3
                                                                                    m-a,12,96,ky,fld,2
                                                                                    m-a,12,99,ky,fld,3
                                                            cadecosa                m-a,12,13,kz,fld,2
                                                            card-dsg-cd-sams        m-a,12,17,ky,fld,3
106   change-bench-stock-list             process                                   m-5,10,a,1
                                                                                    m-5,10,e
                                                                                    m-5,10,d,2
                                                            chbestli                m-5,8,j
107   change-equip-recall-data            process           chegreda                m-5,8,d
108   change-float-authorization          process           chflau                  m-5,8,e
109   change-indication-code              *** undefined ***
110   change-maint-prod-prgm-data         process           chmaprprda              m-5,8,f
111   change-part-number                  process           chpanu                  m-5,8,i
112   change-personnel-assignments        process           chpeas                  m-5,8,h
113   change-shop-stock-list              process                                   m-5,10,e
                                                                                    m-5,10,d,2
                                                                                    m-5,10,a
                                                            chshstli                m-5,8,j
114   change-toe-tda-authorization        process           chtotdau                m-5,8,h
115   change-work-request-status          process           chworest                m-5,8,1
116   characters-per-line                 *** undefined *** chpeli
117   chd-prt-no-fld                      *** undefined ***
118   close-out-wo                        process           clouwo
119   closed-supply-transactns-rpt        output            clsutrrp                m-b,o2,37,4w
120   closed-work-order-register          set               clwoorre                m-4,11,s
```

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

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name list

	name	type	synonym	paragraph
121	comp-ser-nu-loc-cont-nu-field	element	comp-sn-lcl-con-no-fld	m-a.12.51.ky.fld.7
			cosenuloco	m-a.12.51.ky.fld.7
122	compare-float-calcs-params	process	colfcapa	m-4.13.1
123	component-breakdown-code	element	cobrco	m-a.12.03.kz.fld.7
			comp-brkdwn-cd	m-a.12.03.kz.fld.7
124	component-serial-number	element	comp-ser-no	m-a.12.04.kz.fld.7
			cosenu	m-a.12.04.kz.fld.7
125	con-no-fld	*** undefined ***		
126	cond-desig-change-indicator	element	codechin	m-a.12.13.kz.fld.18
			cond-dsg-ch-indic	m-a.12.13.kz.fld.18
127	cond-desig-master-record	element	codemare	m-a.12.99.ky.fld.8
			cond-dsg-mstr-rec	m-a.12.99.ky.fld.8
128	cond-desig-reimbursable-cust	element	coderecu	m-a.12.01.kz.fld.15
			cond-dsg-reimb-cust	m-a.12.01.kz.fld.15
129	cond-desig-reports-req	element	coderere	m-a.12.98.ky.fld.5
			cond-dsg-rept-rqmts	m-a.12.98.ky.fld.5
130	cond-desig-substitute-item	element	codesuit	m-a.12.13.kz.fld.8
			cond-dsg-sub-item	m-a.12.13.kz.fld.8
131	cond-designator-requis-action	element	codereac	m-a.12.03.kz.fld.6
			cond-dsg-rqn-act	m-a.12.03.kz.fld.6
132	cond-dsg-rep-rqmt	*** undefined ***		
133	cond-dsg-rep-rqmt	*** undefined ***		
134	cond-dsg-rqn-act-code	element	codsrqacco	m-4.12.r.7
135	condition-code	element	coco	
			cond-cd	
136	condition-desig-15-day-table	element	code15data	m-a.12.17.ky.fld.9
			cond-dsg-day-tbl	m-a.12.96.ky.fld.4
137	condition-desig-all-records	element	codealre	m-a.12.17.ky.fld.21
			cond-dsg-all-rcds	m-a.12.17.ky.fld.21
138	condition-desig-conus-location	element	codecolo	m-a.12.17.ky.fld.10
			cond-dsg-conus-loc	m-a.12.17.ky.fld.9
139	condition-designator-code	element	codeco	
140	condition-designator-warranty	element	codewa	m-a.12.02.kz.fld.18
			cond-dsg-wrnt	m-a.12.07.8m.fld.18
141	condition-dsg-req-action	element		m-b.o2.38.4v.fld.9
142	condition-master-record	element	comare	
			cond-mstr-rec	
143	conditn-desig-document-history	element	codedohi	m-a.12.13.kz.fld.12
			cond-dsg-docu-hist	m-a.12.13.kz.fld.12

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

name list

	name	type	synonym	paragraph
144	control-float	process	cofl	
145	cost-data	input	coda	m-4.10.o.5
146	crd-dsq	*** undefined ***		
147	cross-ref	*** undefined ***		
148	cross-reference-transaction	input	crretr	
149	cross-reference-transactn-data	set	crretrda	m-a.12.99.ky
150	cust-equip-pickup-notice	output		m-4.10.v
				m-4.10.u
			cueqpino	m-4.10.t
151	customer	interface	cu	m-4.14.c
152	customer-maint-control	interface	cumaco	
153	customer-relatd-forms-repts	set	curefore	
154	customer-work-order-reconcil	set	cuwoorre	m-b.o2.06.4w
155	da-of-yr-aval-shpmt	element		m-b.o2.35.4d.fld.67
156	daps-file	set	dafi	m-4.11.o
157	daily	attribute-value		
158	daily-supply-transactions-data	set	dasutrda	m-b.o2.35.4d
159	daily-supply-transactions-rept	output		m-4.12.r.10
			dasutrre	m-4.12.r.1
160	data-element-abbreviation	element	daelab	m-a.12.96.ky.fld.5
			de-abbr	m-a.12.96.ky.fld.5
161	date-accepted-ordinal	element		m-b.o2.02.4d.fld.41
				m-b.o2.30.4w.fld.18
			daacor	m-b.o2.02.4d.fld.10
			date-acpt-ord	m-b.o2.02.4d.fld.26
162	date-asdd-ord	element		m-b.o2.52.8w.fld.4
				m-b.o2.51.4r.fld.15
163	date-assigned-ordinal	element	daasor	m-a.12.70.ky.fld.15
			date-asgn-ord	m-a.12.70.ky.fld.15
164	date-completed-ordinal	element		m-b.o2.09.4w.fld.10
				m-b.o2.09.4w.fld.11
			dacoor	m-b.o2.05.5d.fld.9
			date-compl-ord	m-b.o2.07.4m.fld.14
165	date-of-receipt-ordinal	element	daofreor	m-b.o2.04.4w.fld.9
			date-rec-ord	m-b.o2.09.4w.fld.32
166	date-pre-ord	*** undefined ***		
167	date-prepared-ordinal	element		m-b.o2.33.4y.fld.1
				m-a.12.52.8r.fld.12
				m-a.12.50.kr.fld.12

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

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name list

	name	type	synonym	paragraph
				m-b.o2.06.4w.fld.1
				m-a.12.61.4m.fld.1
				m-b.o2.20.4r.fld.1
				m-b.o2.34.4y.fld.1
				m-b.o2.11.4y.fld.1
				m-b.o2.08.4m.fld.1
				m-b.o2.07.4m.fld.1
				m-b.o2.23.4m.fld.1
				m-b.o2.22.4m.fld.1
				m-b.o2.02.4d.fld.1
				m-b.o2.40.4r.fld.1
				m-b.o2.36.4w.fld.1
				m-b.o2.35.4d.fld.1
				m-b.o2.10.4v.fld.1
				m-b.o2.30.4w.fld.29
				m-b.o2.30.4w.fld.1
				m-b.o2.50.4w.fld.1
				m-b.o2.42.4y.fld.1
				m-b.o2.41.4y.fld.1
				m-b.o2.39.4m.fld.1
				m-b.o2.38.4y.fld.1
				m-b.o2.36.4w.fld.23
				m-b.o2.21.4w.fld.1
				m-b.o2.37.4w.fld.1
				m-b.o2.32.4d.fld.34
				m-b.o2.32.4d.fld.5
				m-b.o2.04.4w.fld.1
				m-b.o2.01.4d.fld.1
				m-a.12.62.4y.fld.1
				m-b.o2.31.4d.fld.1
				m-b.o2.05.5d.fld.1
				m-b.o2.09.4w.fld.1
				m-b.o2.51.4r.fld.1
				m-a.12.63.4m.fld.1
			dapror	m-a.12.31.4q.fld.1
			date-prep-ord	m-a.12.32.4q.fld.1
168	date-start-ord	element		m-b.o2.09.4w.fld.8
169	date-status-ordinal	element	dastor	m-b.o1.01.4d.fld.5
			date-sta-ord	m-b.o1.01.4d.fld.5

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

name list

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     name                               type         synonym                 paragraph

170  day-of-year-avail-for-shipmnt      element      da-of-yr-aval-shipmt    m-a.12.16.8d.fld.18
                                                     daofyeavfo              m-a.12.16.8d.fld.18
171  days-awaiting-parts                element      da-awto-prts            m-b.o2.30.4w.fld.20
                                                     daawpa                  m-b.o2.30.4w.fld.20
172  delete-lookup-table-data           process      delotada                m-4.10.tt.2
173  demand-code                        element                              m-a.12.15.8d.fld.9
                                                                             m-b.o2.35.4d.fld.47
                                                                             m-a.12.17.ky.fld.18
                                                                             m-b.o2.42.4y.fld.17
                                                                             m-a.12.16.8d.fld.9
                                                                             m-b.o2.35.4d.fld.30
                                                                             m-b.o2.35.4d.fld.12
                                                                             m-a.12.17.ky.fld.17
                                                                             m-b.o2.35.4d.fld.60
                                                     deco                    m-a.12.03.kz.fld.18
                                                     dmd-cd                  m-a.12.08.8m.fld.16
174  determine-required-calibration     process      dereca                  m-4.14.e
175  determine-required-maint           process      derema
176  detrmne-required-maint-service     process      deremase                m-4.14.e
177  distribute-tnf-data                process      ditpda                  m-4.18.b
178  distribution-code                  element      dico
                                                     distr-cd
179  document-code-identifier           attribute    docoid
180  document-control-number            element                              m-a.12.15.8d.fld.8
                                                                             m-a.12.18.8m.fld.7
                                                                             m-a.12.16.8d.fld.8
                                                                             m-b.o2.31.4d.fld.7
                                                                             m-b.o2.30.4w.fld.24
                                                                             m-b.01.07.4d.fld.5
                                                                             m-b.o2.09.4w.fld.25
                                                                             m-b.o2.32.4d.fld.21
                                                                             m-b.o2.33.4y.fld.12
                                                                             m-b.o2.32.4d.fld.31
                                                                             m-b.o2.35.4d.fld.46
                                                                             m-b.o2.35.4d.fld.29
                                                                             m-b.o2.35.4d.fld.11
                                                                             m-b.o2.34.4y.fld.5
                                                                             m-b.o2.35.4d.fld.59
                                                                             m-b.o2.36.4w.fld.5
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Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

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                              LOGICON LEXINGTON VAX SYSTEM

                                        name list

      name                                type                synonym                paragraph

                                                                                     m-b,o2.35.4d.fld.68
                                                                                     m-b,o2.37.4w.fld.5
                                                              doconu                 m-a.12.03.kz.fld.14
                                                              docu-con-no            m-a.12.13.kz.fld.5
 181  document-id-code-supply-action      element             dic-sup-act            m-a.12.13.kz.fld.17
                                                              doidcosuac             m-b,o2.36.4w.fld.16
 182  document-register-data-out          set                 doredaou
 183  documentation-identifer-code        *** undefined ***
 184  documentation-identifier-code       element                                    m-b.o1.01.4d.fld.1
                                                                                     m-a.12.99.ky.fld.1
                                                                                     m-a.12.15.8d.fld.1
                                                                                     m-a.12.03.kz.fld.1
                                                                                     m-a.12.02.kz.fld.1
                                                                                     m-b.o2.35.4d.fld.23
                                                                                     m-a.12.04.kz.fld.1
                                                                                     m-a.12.06.ky.fld.1
                                                                                     m-a.12.05.kz.fld.1
                                                                                     m-a.12.40.ky.fld.1
                                                                                     m-a.12.12.ky.fld.1
                                                                                     m-a.12.13.kz.fld.9
                                                                                     m-a.12.13.kz.fld.1
                                                                                     m-a.12.18.8m.fld.1
                                                                                     m-b.01.02.4d.fld.1
                                                                                     m-b.o2.35.4d.fld.54
                                                                                     m-a.12.20.kr.fld.1
                                                                                     m-a.12.17.ky.fld.1
                                                                                     m-a.12.16.8d.fld.1
                                                                                     m-a.12.98.fld.1
                                                                                     m-b.o2.35.4d.fld.5
                                                                                     m-a.m-a.12.17.ky.fld
                                                                                     m-a.12.97.ky.fld.1
                                                                                     m-a.12.98.ky.fld.1
                                                                                     m-b.o2.35.4d.fld.41
                                                                                     m-a.12.96.ky.fld.1
                                                                                     m-a.12.30.ky.fld.1
                                                                                     m-a.12.70.ky.fld.1
                                                                                     m-a.12.50.kr.fld.1
                                                                                     m-a.12.60.ky.fld.1
                                                                                     m-a.12.51.ky.fld.1
```

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

name list

	name	type	synonym	paragraph
			dic	m-4.10.q
			doidco	m-a.12.01.kz.fld.1
185	doidcosu	element		m-a.12.13.kz.fld.14
186	ds-data-missing-og-A44	memo		
187	ds-maintenance	interface	dsma	
188	ds-shop-operator-makes-repairs	memo	dsshopmare	m-4.10.ii
189	edd-ord	element		m-b.o2.36.4w.fld.22
190	edit-transactions	process	edtr	m-5.8.p
191	employee-number-field	element		m-b.o2.52.8w.fld.1
				m-b.o2.51.4r.fld.8
			emnufi	m-a.12.04.kz.fld.7
			empl-no-fld	m-a.12.70.ky.fld.8
192	end-item-component-indic-field	element		m-a.12.30.ky.fld.14
				m-a.12.33.8m.fld.4
			end-item-comp-ind-fld	m-a.12.01.kz.fld.9
			enitcoinfi	m-a.12.07.8m.fld.16
193	end-item-national-stock-number	element	ei-nsn	m-b.o1.01.4d.fld.7
			enitnastnu	m-b.o1.01.4d.fld.7
194	ent-assigned-work-order-number	process		m-4.17.a
			enaswoornu	m-4.15.b
195	ent-prod-program-mgmt-detrmn	process	enprormode	m-4.17.j
196	enter-alt-sro-data	process	enalsrda	
197	enter-bslf-change-data	process	enbschda	m-4.12.a
198	enter-class-inspectn-form-data	process	enclinfoda	m-4.10.o.5
199	enter-da-form-data	process	endafoda	m-4.12.e
200	enter-equipment-usage-data	process	enequsda	m-4.10.jj
201	enter-float-adjustments	process	enflad	m-4.13.i
202	enter-float-changes	process	enflch	m-5.11.f
203	enter-initial-wo-data	process	eninwoda	
204	enter-labor-usage-data	process	enlausda	m-5.8.c.1
205	enter-lookup-table-data	process	enlotada	m-5.8.q
206	enter-parameter-data	process	enpada	m-5.8.r
207	enter-part-number-change	process	enpanuch	m-4.10.rr
208	enter-parts-receipt-data	process		m-5.10.c.1
			enpareda	m-5.8.k
209	enter-parts-status-data	process		m-5.10.c.2
			enpastda	m-5.8.k
210	enter-parts-usage-data	process	enpausda	m-5.8.c.2
211	enter-personnel-data-changes	process	enpedach	m-4.10.qq

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

name list

```
     name                                   type              synonym           paragraph

212  enter-production-wo-data               process           enprwoda
213  enter-reconcilation-parts-data         process                             m-5.10.c.3
                                                              enrepada          m-5.8.k
214  enter-registration-wo-data             process           enrewoda          m-5.8.a
215  enter-repair-parts-form-data           process           enrepafoda        m-4.12.b
216  enter-shop-supply-data                 process           enshsuda          m-4.12.r.7
217  enter-standard-wo-data                 process           enstwoda
218  enter-task-completion-data             process           entacoda          m-5.8.c
219  enter-task-perf-factor-adj             process           entapefaad        m-5.8.m
220  enter-usage-data                       process           enusda            m-5.8.n
221  enter-wo-completion-data               process           enwocoda          m-4.10.q
222  enter-wo-evacuation-data               process           enwoevda          m-4.10.r
223  enter-wo-parts-reassignments           process           enwopare          m-4.10.ss
224  enter-wo-requirements-data             process                             m-5.10.b
                                                              enworeda          m-5.8.b
225  enter-wo-supplmntal-parts-data         process                             m-4.12.k
                                                              enwosupada        m-4.12.h
226  enter-wo-update-data                   process           enwoupda
227  enter-work-order-parts-data            process           enwoorpada        m-4.12.d
228  enter-work-order-status-update         process                             m-4.10.aa
                                                                                m-4.10.pp
                                                              enwoorstup        m-4.10.w.3
                                                              enwostup          m-4.10.mm
229  enter-work-order-task-data             process                             m-4.10.x.5
                                                              enwoortada        m-4.10.q
230  enter-work-order-time-expended         process                             m-4.10.x.5
                                                              enwoortiex        m-4.10.q
231  eqreneita                              input
232  equip-level-maint-all-chrt-out         output            eqlemalchou       m-4.7.c.1
233  equip-oper-ready-net-change            element           eor-net-ch
                                                              eqoprenech
234  equip-recall-deling-list-reqst         input             eqredelire        m-4.14.m
235  equip-recall-deling-report             output            eqredere          m-b.o2.23.4m
236  equip-recall-delinquency-list          set               eqredeli          m-4.14.m
237  equip-ser-lcl                          *** undefined ***
238  equip-ser-lcl-con-no-field             element                             m-b.o2.06.4w.fld.8
                                                                                m-b.o2.07.4m.fld.10
                                                                                m-b.o2.20.4r.fld.10
                                                                                m-b.o2.05.5d.fld.12
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Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

name list

	name	type	synonym	paragraph
				m-b.o2.23.4m.fld.8
				m-b.o2.22.4m.fld.8
			equip-ser-lcl-con-no-fld	m-b.o1.01.4d.fld.9
239	equip-ser-lo-cont-no-fld	element		m-b.o2.04.4w.fld.12
240	equip-serial-lcl-con-no-fld	element	eqseloconu	
241	equip-set-lcl-con-no-fld	*** undefined ***		
242	equip-usage-measurement-code	element	equip-use-meas-cd	m-a.12.04.kz.fld.13
			equsmeco	m-a.12.04.kz.fld.13
243	equipment-category-code	element		m-b.01.02.4d.fld.12
				m-a.12.96.ky.fld.4
				m-a.12.33.8m.fld.16
				m-b.o2.01.4d.fld.4
				m-b.o2.01.4d.fld.44
				m-b.o2.01.4d.fld.24
				m-b.o2.30.4w.fld.8
				m-b.o2.03.4d.fld.22
				m-b.o2.03.4d.fld.4
				m-b.o2.03.4d.fld.51
				m-a.12.30.ky.fld.14
			ecc	m-a.12.02.kz.fld.8
			eqcaco	m-a.12.07.8m.fld.24
244	equipment-category-description	element	eqcade	
245	equipment-category-descriptios	element		m-b.o2.01.4d.fld.37
				m-b.o2.03.4d.fld.52
				m-b.o2.03.4d.fld.23
				m-b.o2.03.4d.fld.5
				m-b.o2.01.4d.fld.58
				m-b.o2.30.4w.fld.9
			equip-cat-descr	m-b.o2.01.4d.fld.17
246	equipment-location	element		m-b.o2.22.4m.fld.12
			eqlo	m-a.12.30.ky.fld.11
			equip-loc	m-a.12.33.8m.fld.18
247	equipment-model-ident-number	element		
248	equipment-model-identif-no	element		m-b.o1.01.4d.fld.8
				m-a.12.32.4q.fld.10
				m-a.12.33.8m.fld.10
			eqmoidnu	m-a.12.30.ky.fld.9
			equip-modl-ident-no	m-a.12.31.4q.fld.10
249	equipment-operator	interface	eqop	

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

name list

	name	type	synonym	paragraph
250	equipment-readiness-code	element	eqreco	m-a.12.01.kz.fld.14
			equip-redn-cd	m-b.01.02.4d.fld.14
			erc	m-b.01.02.4d.fld.14
251	equipment-recall-data	set	eqreda	m-a.12.30.ky
252	equipment-recall-data-xx	set	eqredaxx	m-a.12.33.8m
253	equipment-recall-delinq-lst	output	eqredels	m-4.7.v.8
254	equipment-recall-delinq-out	set	eqredeou	m-b.o2.23.4m
255	equipment-recall-new-item-a	input		
256	equipment-recall-new-item-b	input	eqreneitb	
257	equipment-recall-require	input	eqrere	
258	equipment-recall-schedule	set	eqresc	m-b.o2.22.4m
259	equipment-recall-schedule-out	output	eqrescou	m-4.14.c
260	equipment-recall-schedule-rep	output	eqrescre	m-b.o2.22.4m
261	equipment-serial-number	element	eqsenu	m-a.12.31.4q.fld.8
			equip-ser-no	m-a.12.32.4q.fld.9
262	equipment-system-	system-parameter		
263	equipment-system-code	element	easyco	m-a.12.30.ky.fld.12
			equip-sys-cd	m-a.12.33.8m.fld.8
264	equipment-utilization-code	element	equip-util-cd	m-a.12.02.kz.fld.20
			equtco	m-a.12.02.kz.fld.20
265	equipment-utilization-field	element	equip-util-fld	m-a.12.30.ky.fld.15
			equtfi	m-a.12.33.9m.fld.15
266	err-msg	element		m-b.o2.30.4w.fld.21
267	error-exception-report-supply	output	erexresu	m-4.12.u
268	error-exception-report-wo	output		m-4.12.u
			erexrewo	m-4.11.1
269	establish-maint-production-prg	process	esmaprpr	m-5.8.f
270	estimated	element	es	m-a.12.04.kz.fld.12
			est-rep-part	m-a.12.04.kz.fld.12
271	estimated-delivery-date	element	edd	m-a.12.18.8m.fld.17
			esdeda	m-a.12.18.8m.fld.17
272	estimated-delivery-date-order	element	esd-ord	m-b.01.02.4d.fld.14
			esdedaor	m-b.o2.35.4d.fld.52
273	estimated-repair-parts-cost	element	esrepaco	m-a.12.13.kz.fld.11
			est-rep-part-cost	m-a.12.13.kz.fld.11
274	estimated-shipment-date	element		m-a.12.16.8d.fld.14
				m-b.o2.35.4d.fld.63
			esd	m-a.12.13.kz.fld.10
			esshda	m-a.12.15.8d.fld.19

Figure D-8. Sample LARE Name List (MOM) (Cont'd.)

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